



# Advanced Cleanup Technologies, Inc.

**ENVIRONMENTAL CONSULTANTS**

## **Periodic Review Report**

**Williamsburg Bridgeview Apartment**

**337 Berry Street**

**Brooklyn, New York 11249**

**NYSDEC BCP Site No. C224233**

**Prepared For:**

**LPC Development Group LLC**

**456 East 173<sup>rd</sup> Street**

**Bronx, NY 10457**

**Prepared By:**

**Advanced Cleanup Technologies, Inc.**

**110 Main Street, Suite 103**

**Port Washington, NY 11050**

**And**

**Andrew R. Levenbaum, P.E.**

**424 New York Avenue**

**Huntington, New York 11743**

**May 26, 2020**



## Table of Contents

|                                                                    |    |
|--------------------------------------------------------------------|----|
| 1. Introduction .....                                              | 4  |
| 2. Institutional Controls .....                                    | 4  |
| 3. Engineering Controls .....                                      | 5  |
| 3.1 Cover System .....                                             | 5  |
| 3.2 Sub-Slab Depressurization System .....                         | 6  |
| 3.2.1 Sub-Slab Depressurization System (SSDS) Overview .....       | 6  |
| 3.2.2 SSDS Monitoring Inspections .....                            | 7  |
| 3.2.3 SSDS Status and Recommended SMP Changes .....                | 9  |
| 3.3 Soil Vapor Extraction System (SVES) .....                      | 9  |
| 3.3.1 SVES Overview .....                                          | 9  |
| 3.3.2 SVES Monitoring Inspections .....                            | 10 |
| 3.3.3 SVES Telemetry Modifications .....                           | 11 |
| 3.3.4 Proposed Modifications to SVES and Monitoring Schedule ..... | 13 |
| 4. Groundwater Monitoring .....                                    | 13 |
| 5. Certification of Institutional and Engineering Controls .....   | 14 |

## List of Tables

|                                                                        |    |
|------------------------------------------------------------------------|----|
| Table 1: SSDS Effluent VOC Concentrations (ug/m3) March 26, 2019 ..... | 7  |
| Table 2: SSDS Well Vacuum (in.WC.) March 25, 2020 .....                | 8  |
| Table 3: SSDS Monitoring Point Vacuum (in.WC.) March 26, 2020 .....    | 8  |
| Table 4: SVES Vacuum and Flow Measurements .....                       | 10 |
| Table 5: SVES Influent and Effluent VOC Concentrations (ug/m3) .....   | 11 |



## List of Figures

| Figure | Title                       | Dates            |
|--------|-----------------------------|------------------|
| 1      | Vacuum(in.w.c)              | 5/2/19-12/26/19  |
| 2      | Influent VOC (ppm)          | 12/28/19-4/24/20 |
| 3      | Effluent VOC (ppm)          | 12/28/19-4/24/20 |
| 4      | Influent VOC (ug/m^3)       | 4/3/20-4/24/20   |
| 5      | Effluent VOC (ug/m^3)       | 4/3/20-4/24/20   |
| 6      | VOC Removal(mg/min)         | 4/3/20-4/24/20   |
| 7      | Vacuum (in.w.c.)            | 3/5/20-4/24/20   |
| 8      | Flow(cfm)                   | 3/5/20-4/24/20   |
| 9      | FPZ K07 Blower Curves       |                  |
| 10     | Influent Pressure (in.w.c.) | 3/5/20-4/24/20   |
| 11     | Flow(cfm)                   | 3/23/20-3/26/20  |
| 12     | Vacuum (in.w.c.)            | 3/23/20-3/26/20  |
| 13     | Influent Pressure (in.w.c.) | 3/23/20-3/26/20  |

## List of Appendices

- A. Site Management Plan
- B. Cover System
- C. SSDS Layout
- D. SVES Layout
- E. SVES Implementation Plan
- F. Groundwater Quality Laboratory Tables
- G. Groundwater Quality Laboratory Reports
- H. Executed IC/EC Certification Form



## **1. Introduction**

The property located at 337 Berry Street, Brooklyn, New York 11249 (the Site) has implemented a New York State Department of Environmental Conservation (NYSDEC) approved Site Management Plan (SMP) dated December 2018. The SMP has identified remaining Tetrachloroethylene (PCE) and Trichloroethylene (TCE) contamination in groundwater above TOGS and chlorinated volatile organic compound (VOC) contamination in soil vapor located under the site. Because remaining contamination was identified at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required and were implemented to protect human health and the environment. A copy of the SMP prepared and certified by Equity Environmental Engineering (Equity) is provided in Appendix A. Section 2.3 of the attached SMP includes a history of investigations and remediation performed at the Site as certified by Equity.

Advanced Cleanup Technologies, Inc. (ACT) and Andrew R. Levenbaum, P.E. (ARL) were retained to perform operation, maintenance and monitoring activities and prepare this Periodic Review Report for the Site pursuant to the approved SMP. This report contains a summary of the current condition of institutional and engineering controls at the Site, the results of the Operation, Maintenance and Monitoring (OM&M) inspections performed to date, and the results of the most recent annual groundwater monitoring event. In addition, ACT and ARL are recommending changes to the SMP including: the monitoring schedule for the Soil Vapor Extraction System (SVES) and the Sub-Slab Depressurization System (SSDS), and changes to the groundwater sampling protocols.

## **2. Institutional Controls**

An Environmental Easement (EE) for the Site was executed by the NYSDEC and filed with the New York City Clerk on November 2, 2018. The EE contains a series of ICs required by the Final Engineering Report (FER) to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to restricted residential, commercial and industrial uses only.





Adherence to these ICs is required by the EE, which are being implemented pursuant to the SMP.

### **3. Engineering Controls**

Since remaining contaminated groundwater and soil vapor exist beneath the Site, EC are required to protect human health and the environment. The Site has the following primary ECs, as described in the following subsections:

- Cover System
- Sub-Slab Depressurization System
- Soil Vapor Extraction System

In accordance with the SMP, site-wide inspections of the cover system, SSDS and SVES are required at a minimum of once per year to verify that all EC's are being maintained and are functioning properly.

The first Site-wide inspection was completed in October 2019 coinciding with the annual groundwater monitoring event. All monitoring wells were inspected as well as the SVES and SSDS to ensure functionality.

#### **3.1 Cover System**

Exposure to remaining contamination in soil/fill at the Site is prevented by a soil cover system placed over the Site. According to the certified SMP, this cover system is comprised of a minimum of 12 to 24 inches of clean soil, asphalt pavement, concrete-covered sidewalks, and/or concrete building slabs. Appendix B contains a diagram identifying the location of each cover type built at the Site. An Excavation Work Plan, which outlines the procedures required in the

event the cover system and/or underlying residual contamination are disturbed, is provided in Appendix A of the SMP.

Inspections of the exterior cover system were performed at startup of the SVES on February 25<sup>th</sup>, 2019 and monthly thereafter. The inspection of the interior foundation floor was performed during the SSDS inspection on March 20, 2020

### **3.2 Sub-Slab Depressurization System**

#### **3.2.1 Sub-Slab Depressurization System (SSDS) Overview**

According to the certified SMP, there is a Sub-Slab Depressurization System (SSDS) located within the building. The site SSDS consists of five (5) zones underneath the building. The zones were designed to address approximately 2,000 square feet of the building footprint. Each zone has a layer of crushed stone and geovent over the stone around its perimeter to act as a permeable layer to transmit vapors through the system. The geovent is connected to sub-slab PVC piping which transitions into cast iron piping above the concrete floor. The cast iron piping travels vertically up through the building and vents on the roof through in-line fans. The system has monitoring points to determine if a vacuum is being created in each zone, alarms in the event that the exhaust fans shut down or air flow is blocked, and vacuum gauges to determine if there is flow. The SSDS is designed to run continuously until such time as the NYSDEC allows for a reduction in use or termination of the system. The layout of the active SSDS installed at the Site is provided in Appendix C.

According to the certified SMP, a vapor barrier consisting of a geosynthetic membrane and liner was installed above the geovent and below the building slab. It was anchored into the foundation wall and properly sealed to make a monolithic barrier to prevent vapor intrusion into the building. The vapor barrier consists of:

- Geosynthetic membrane
- WR Grace Florprufe 120
- Preprufe Tape

- Bithuthene
- Hilti anchor system to anchor the Preprufe to the foundation walls

### 3.2.2 SSDS Monitoring Inspections

Prior to ACT's and ARL's involvement, the SSDS and monitoring points had previously been installed by Equity. The first monitoring inspection of the SSDS was performed by ACT on March 26, 2019 for the purpose of verifying that the five SSDS blowers on the roof were functioning and collecting effluent air samples from the SSDS riser pipes on the roof of the recently constructed building. The laboratory results from the SSDS exhaust sampling are summarized in Table 1.

**Table 1: SSDS Effluent VOC Concentrations (ug/m3) March 26, 2019**

| Parameter                                                   | NYSDOH Air Guideline | Sampling Location |        |        |        |        |
|-------------------------------------------------------------|----------------------|-------------------|--------|--------|--------|--------|
|                                                             |                      | SSDS-1            | SSDS-2 | SSDS-3 | SSDS-4 | SSDS-5 |
| Tetrachloroethene                                           | 30                   | 3.2               | 0.46   | 3.3    | 4.3    | ND     |
| Trichloroethene                                             | 2                    | 1.3               | ND     | 0.51   | 0.97   | ND     |
| 1,1,1-Trichloroethane                                       | NA                   | ND                | ND     | ND     | ND     | ND     |
| cis-1,2-Dichloroethene                                      | NA                   | 0.33              | ND     | 0.32   | ND     | ND     |
| NA = Not Available                                          |                      |                   |        |        |        |        |
| ND = Not detected above laboratory's method detection limit |                      |                   |        |        |        |        |

It can be seen from Table 1 that from one to three VOCs included in the NYSDOH's Decision Matrices were detected in four of the five SSDS effluent samples. However, all the VOCs were detected below NYSDOH Air Guidelines. Therefore, effluent treatment of the SSDS exhaust should not be necessary.

Between March 25 and 26, 2020, a site-inspection of the SSDS was completed. Vacuum readings were taken from 4 of the 5 SSDS wells, statuses of the alarms were checked, and vacuum readings from accessible monitoring points were collected. Due to lack of access, the fifth vacuum well was not measured. Due to obstructions in 3 of the 5 monitoring points, vacuum

readings from only two permanent monitoring points could be collected. Therefore, two additional temporary sub-slab vacuum points were installed just below the concrete slab to verify the SSDS was maintaining an effective negative pressure field under the entirety of the building. The results of the SSDS monitoring inspection is included in Tables 2 and 3. The locations of the existing and newly installed monitoring points are included in Appendix C.

**Table 2: SSDS Well Vacuum (in.WC.) March 25, 2020**

| Well | Alarm Functional | Vacuum(in.WC) |
|------|------------------|---------------|
| ZR-1 | Yes              | 1.4           |
| ZR-2 | Yes              | 2.7           |
| ZR-3 | Yes              | 1.5-1.6       |
| ZR-4 | Yes              | 2             |
| ZR-5 | NM               | NM            |

\*NM=Not Measured

**Table 3: SSDS Monitoring Point Vacuum (in.WC.) March 26, 2020**

| Monitoring Point | Vacuum(in.wc.) |
|------------------|----------------|
| TVP-1            | 0.027          |
| TVP-2            | 0.183          |
| MP-1             | 0.143          |
| MP-4             | 0.07           |

In table 2 it can be seen that all 4 accessible vacuum wells were functional, the alarms for all wells were functional, and all wells were maintaining effective vacuum. In table 3, all SSDS vacuum monitoring points had vacuums that were above the above the DOH recommended guideline of 0.025 in.wc., demonstrating that the SSDS is maintaining an effective vacuum field under the entirety of the building

### **3.2.3 SSDS Status and Recommended SMP Changes**

The SSDS was operating during our initial inspection on March 26, 2019 and the most recent inspections on March 25 and 26, 2020, with no alarm states reported over the past year by management or onsite personnel. During the most recent inspection, four of the five accessible SSDS vacuum wells were observed to be maintaining negative pressure, all five SSDS blowers on the roof were functioning and it was confirmed that the system is currently maintaining an effective negative pressure field under the full extent of the building.

The above inspections indicate that the SSDS is stable and maintaining negative pressure beneath the building. Furthermore, no alarm states indicating a loss of vacuum were reported by management or onsite personnel over the past year. Therefore, we recommend monitoring of the SSDS in the SMP be reduced from quarterly to annually. In addition, because VOC concentrations in the SSDS effluent were below air guidelines during startup sampling, we recommend removing annual air sampling of the five SSDS zones from the SMP.

## **3.3 Soil Vapor Extraction System (SVES)**

### **3.3.1 Soil Vapor Extraction System (SVES) Overview**

The SVES was installed in the parking lot area of the site to address potential vapor intrusion into neighboring properties along Berry Street. The system consists of four (4) PVC extraction wells that extend approximately 15 feet below grade with 5-foot screens and horizontal PVC piping approximately 4-feet deep to a package treatment plant. The package plant key components include the system controls, vacuum blower, moisture separator, and activated Carbon canisters to remove VOCs from the vapor. The system is designed to run continuously until such time as the removal rates become asymptotic or negligible and the DEC allows for a reduction of use or termination of the system. The as-built layout of the SVES is provided in Appendix D.

### 3.3.2 SVES Monitoring Inspections

Pursuant to the approved SVES Implementation Plan contained in Appendix E, startup inspections of the SVES were performed once all piping and equipment were installed and energized.

Monitoring inspections of the SVES were performed on February 25<sup>th</sup>, 2019 and monthly thereafter. During monitoring inspections, system pressures and flow rates were recorded.

**Table 4: SVES Vacuum and Flow Measurements**

| Date                                                             | 2/25/19           | 3/11/19                                   | 4/30/19                                    | 5/31/19                   | 6/21/19                   | 7/30/19                                                               | 9/3/19             | 10/24/19                                                          | 12/5/19                                                           | 1/17/20            | 2/26/20                   |
|------------------------------------------------------------------|-------------------|-------------------------------------------|--------------------------------------------|---------------------------|---------------------------|-----------------------------------------------------------------------|--------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|--------------------|---------------------------|
| Blower Vac                                                       | 85                | 83                                        | 80                                         | 79                        | 76                        | 78-82                                                                 | 73-75              | 79                                                                | 82                                                                | 80-81              | 80                        |
| SVE-1 Vac                                                        | 84                | 82                                        | 69                                         | 75                        | 72                        | 70                                                                    | 70                 | 76-77                                                             | 80                                                                | 78-79              | 78                        |
| SVE-2 Vac                                                        | NM                | 82                                        | 63                                         | 70                        | 55-68                     | 62                                                                    | 65                 | 68                                                                | 68                                                                | 70                 | 74-76                     |
| SVE-3 Vac                                                        | NM                | 80                                        | 65                                         | 71                        | 62-66                     | 60-70                                                                 | NM                 | NM                                                                | NM                                                                | NM                 | 72-76                     |
| SVE-4 Vac                                                        | NM                | 82"                                       | 70                                         | 76.5                      | 72                        | 62-68                                                                 | 70-72              | 75-76                                                             | 81-82                                                             | 78-79              | 78                        |
| Flow (cfm)                                                       | 80.5              | 90                                        | 79.5                                       | 97                        | 110                       | 114                                                                   | 99.5               | 112                                                               | 110                                                               | 113.5              | 7.5                       |
| PID Reading (ppb)                                                | 425               | 160                                       | 0                                          | 0                         | 0                         | 0                                                                     | 400                | 0                                                                 | 0                                                                 | 37                 | 0                         |
| Sample Collected                                                 | No                | Yes                                       | Yes                                        | Yes                       | Yes                       | Yes                                                                   | Yes                | Yes                                                               | Yes                                                               | Yes                | Yes                       |
| Observations                                                     | 0 PID post-carbon | System off on arrival; Water in SVE wells | System off on arrival; installed telemetry | 0 PID pre and post-carbon | 0 PID pre and post-carbon | Several System restarts required in month of July; Water in SVE Wells | SVE-3 inaccessible | SVE-3 inaccessible, water in SVE wells, 0 PID pre and post-carbon | SVE-3 inaccessible, water in SVE wells, 0 PID pre and post-carbon | SVE-3 inaccessible | 0 PID pre and post-carbon |
| Notes:<br>Vacuum measurements unit: in. W.C.<br>NM= not measured |                   |                                           |                                            |                           |                           |                                                                       |                    |                                                                   |                                                                   |                    |                           |

It can be seen from Table 4 that the SVES had automatically shut down on four inspections following startup due to a buildup of water in the moisture separator. The accumulated stormwater was subsequently drained into 55-gallon drums and left on-site pending laboratory analysis. The laboratory results indicated that a trace concentration of TCE (0.22 ug/L) was the only chemical of concern detected in the drummed water. The TCE level was well below its TOGS 1.1.1 groundwater and effluent discharge standard, so the drummed water was discharged into the municipal sewer.

The vacuum generated by the SVES was steadily reduced during the first few inspections using the installed variable frequency drive until the water accumulated from transient storm events was minimized. In May 2019, a remote telemetry system was installed within the treatment shed to ensure that subsequent system outages could be serviced immediately, and appropriate operating adjustments made. Figure 1 contains the logged blower vacuum telemetry



data from May 2, 2019 to December 26, 2019, which demonstrates that the frequency of shutdowns has been greatly reduced once the blower vacuum was reduced to a final vacuum of 78 in.w.c.

The laboratory results from the SVES exhaust sampling are summarized in Table 5. It can be seen from Table 5 that VOC concentrations increased slightly from March to April 2019, which is expected immediately following startup of the SVES, and has remained stable over the past year. It can also be seen that for any VOC compounds with a significant concentration, between 99.7 and 100 percent of the VOC emissions were captured by the vapor-phase granular activated carbon adsorbers installed within the treatment shed.

**Table 5: SVES Influent and Effluent VOC Concentrations (ug/m3)**

| Parameter                                                   | SVES Exhaust Sampling Event |          |             |                |          |             |                                                                   |          |             |               |          |             |
|-------------------------------------------------------------|-----------------------------|----------|-------------|----------------|----------|-------------|-------------------------------------------------------------------|----------|-------------|---------------|----------|-------------|
|                                                             | March 11, 2019              |          |             | April 30, 2019 |          |             | May 31, 2019                                                      |          |             | June 26, 2019 |          |             |
|                                                             | Influent                    | Effluent | Removal (%) | Influent       | Effluent | Removal (%) | Influent                                                          | Effluent | Removal (%) | Influent      | Effluent | Removal (%) |
| Tetrachloroethene                                           | 460                         | 0.27     | 99.9        | 550            | 1.4      | 99.7        | 420                                                               | ND       | 100         | 380           | ND       | 100         |
| Trichloroethene                                             | 320                         | ND       | 100         | 450            | 0.79     | 99.8        | 350                                                               | ND       | 100         | 220           | ND       | 100         |
| 1,1,1-Trichloroethane                                       | 18                          | ND       | 100         | 17             | ND       | 100         | 9                                                                 | ND       | 100         | 7             | ND       | 100         |
| Cis-1,2-Dichloroethene                                      | 5.8                         | ND       | 100         | 15             | ND       | 100         | 7.6                                                               | ND       | 100         | 5.9           | ND       | 100         |
| ND = Not detected above laboratory's method detection limit |                             |          |             |                |          |             | 9311-INF and 9311-EFF from 5/31/19 samples swapped in lab results |          |             |               |          |             |

| Parameter                                                   | SVES Exhaust Sampling Event |          |             |                   |          |             |                  |          |             |                  |          |             |
|-------------------------------------------------------------|-----------------------------|----------|-------------|-------------------|----------|-------------|------------------|----------|-------------|------------------|----------|-------------|
|                                                             | July 30, 2019               |          |             | September 3, 2019 |          |             | October 24, 2019 |          |             | December 5, 2019 |          |             |
|                                                             | Influent                    | Effluent | Removal (%) | Influent          | Effluent | Removal (%) | Influent         | Effluent | Removal (%) | Influent         | Effluent | Removal (%) |
| Tetrachloroethene                                           | 410                         | ND       | 100         | 610               | 1.5      | 99.8        | 550              | ND       | 100         | 390              | 1.9      | 99.5        |
| Trichloroethene                                             | 240                         | ND       | 100         | 320               | 0.49     | 99.8        | 250              | 0.23     | 99.9        | 300              | 1        | 99.7        |
| 1,1,1-Trichloroethane                                       | 7.8                         | ND       | 100         | 13                | ND       | 100         | 12               | ND       | 100         | 6                | ND       | 100         |
| Cis-1,2-Dichloroethene                                      | 5.1                         | ND       | 100         | 10                | 0.97     | 90.3        | 7.5              | 4        | 46.7        | 3                | 2.2      | 26.7        |
| ND = Not detected above laboratory's method detection limit |                             |          |             |                   |          |             |                  |          |             |                  |          |             |

### 3.3.3 SVES Telemetry Modifications

In December 2019, the telemetry system for the SVES was upgraded to continually monitor influent and effluent VOC concentrations through two photo ionization detectors (PIDs) with a range of 0-2ppm and minimum detectable quantity of 0.5ppb. Figures of all logged telemetry data have been attached to this report. In addition, access to the live logged data is available here: <https://datastudio.google.com/open/1jUleivpgHCLoKxypjTpOUmiItwWn3mdr?usp=sharing>

Both continuous influent and effluent concentrations measured by the PIDs correlate very closely to the collected lab results. They also demonstrate that the carbon filters are effectively removing VOC's and the carbon filters will not be exhausted for some time. It can be seen in Figure 2 that influent VOC concentrations have been extremely stable at 0.2 ppm with a few short-term spikes. In addition, Figure 3 shows the effluent VOC concentrations have been stable varying minimally around 0 ppb with the max concentrations of around 0.04 ppm.

In March 2020, the telemetry system for the SVES was further upgraded to continually monitor SVES blower vacuum, influent carbon pressure, and SVES flowrate. In April 2020, the PID sensors in the telemetry system were calibrated using the monthly monitoring laboratory air results to correlate the sensors' readings to the system-specific air composition. Figures 4 and 5 display the logged VOC concentrations of the influent and effluent of the system in  $\mu\text{g}/\text{m}^3$ . In figure 6, the influent concentration of the system was multiplied by the system flowrate to calculate a mass removal rate for the system. The mass removal has varied between 0.5 mg/min to 3 mg/min with an average of approximately 2.5 mg/min. This mass removal rate suggests the system is removing approximately 3.6 grams of VOC per day.

The logged results from the March 2020 telemetry upgrade correlate closely with data collected during monthly inspections and demonstrate that the system is extremely stable. In Figure 7, the blower vacuum has averaged around 78.75 in wc with fluctuations between 77.72 in wc and 79.45 in wc. In Figure 8, it can be seen that system flow has averaged around 127 cfm with fluctuations between 120 and 130 cfm. These values are similar to values recorded during the monthly inspections and correspond closely to the supplied blower curves for the FPZ K07 motor operating at 50 hz that is attached in Figure 9.

In Figure 10, it can be seen that the pressure at the influent to the carbon filters has been minimal averaging around 0.28 in wc. This value is being monitored as an indicator of the carbon filters being exhausted or a blockage in the exhaust of the SVE system. The value logged from the sensor is lower than the typical value recorded during the monthly inspections of around 1.25 in.wc. This discrepancy will be investigated going forward.

On the night of March 23, 2020, following a rainstorm, the moisture separator filled and turned the system off. In Figures 11 through 13 it can be seen that the blower vacuum, influent pressure, and flow rate all dropped significantly. As a result, ACT was notified the system had been turned off. Upon the inspection on March 25, 2020, the moisture separator was emptied, and the system was restarted.

### **3.3.4 Proposed Modifications to SVES and Monitoring Schedule**

The SSDS and SVES engineering controls are currently functioning nominally. The installed remote telemetry system demonstrates that the SVES has operated continuously since July of 2019 with minimal shutdowns that have been identified and rapidly resolved. The SVES has been consistently producing over 120 cfm of flow with approximately 80 in.w.c. of vacuum. The influent vapor concentrations with the existing vapor phase carbon treatment have remained extremely low over the last year with over 99 percent removal efficiency.

Considering the SVES's stability and the continuous 24/7/365 monitoring of influent VOC, effluent VOC, vacuum, flow, and influent pressure, it is recommended that in-person inspection and exhaust monitoring be reduced from monthly to annually. Additional SVES inspections will be performed as required by the telemetry system for significant pressure, flow, or PID fluctuations due to (1) the moisture separator being full, (2) power outage, (3) requirement for pre-filter replacement, (4) carbon filter exhaustion, or (5) any other unforeseen factors impacting nominal operation of the SVES.

## **4. Groundwater Monitoring**

Annual groundwater monitoring of the three recently installed onsite groundwater monitoring wells is required in accordance with the SMP. The first round of groundwater monitoring by ACT included sampling from the three onsite monitoring wells (MW-1, MW-2



and MW-3). The groundwater quality results are summarized in Appendix F. The complete groundwater quality laboratory data are contained in Appendix G.

The laboratory results show exceedances of PCE in all three monitoring wells above the NYSDEC TOGS Standards and Guidance Values(TOGS) with concentrations up to 50 ug/L in MW-1. TCE also exceeded TOGS in MW-1 with a concentration of 15 ug/l. In addition to VOCs, there were exceedances of sodium above TOGS in MW-1 and MW-3 with concentrations as high as 94800 ug/l in MW-1. Exceedances of metals have been identified in previous reports and were noted in the SMP.

Because sodium is naturally occurring and elevated levels are commonly found in groundwater near brackish water bodies such as the East River, it is recommended that future groundwater monitoring be limited to VOC's only.

## **5. Certification of Institutional and Engineering Controls**

The following certification has been prepared by a Professional Engineer licensed to practice in New York State as per the requirements of NYSDEC DER-10:

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*

- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

*I, Andy R. Levenbaum, P.E. of Levenbaum, am certifying as the Remedial Party's Designated Site Representative. I have been authorized and designated by the Remedial Party to sign this certification for the Site. I certify that all information and statements in this certification form are true.*



Andrew R. Levenbaum, P.E.



# Figures

Presentation

Management

Contact Logout 

System

Logged In: Paul Stewart  
Account: BerryBrooklyn

SVE Vacuum

Overview

Alarm

Historical data

Browse devices

Map

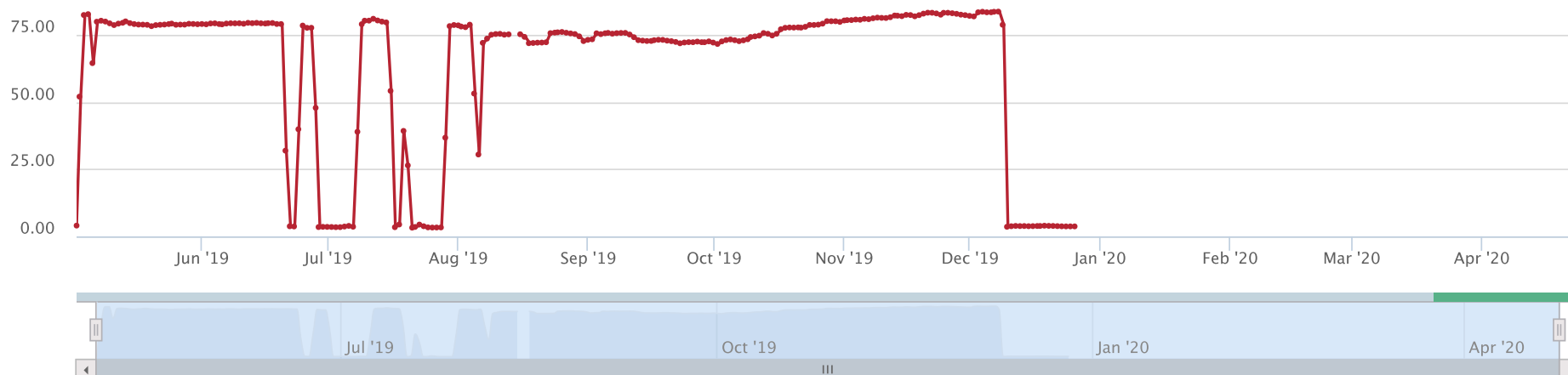
Information

Time zone US/Eastern

## Aggregated day data

Zoom 1d 1w 1m 3m 6m YTD 1y All

From 2019-05-02 00:00 To 2020-04-24 09:24



## Available Parameters:

Drag the parameter here to remove it  
from the chart

## Left Axis:

SVE Vacuum at Blower Intake  
SVE Vacuum in. H2O

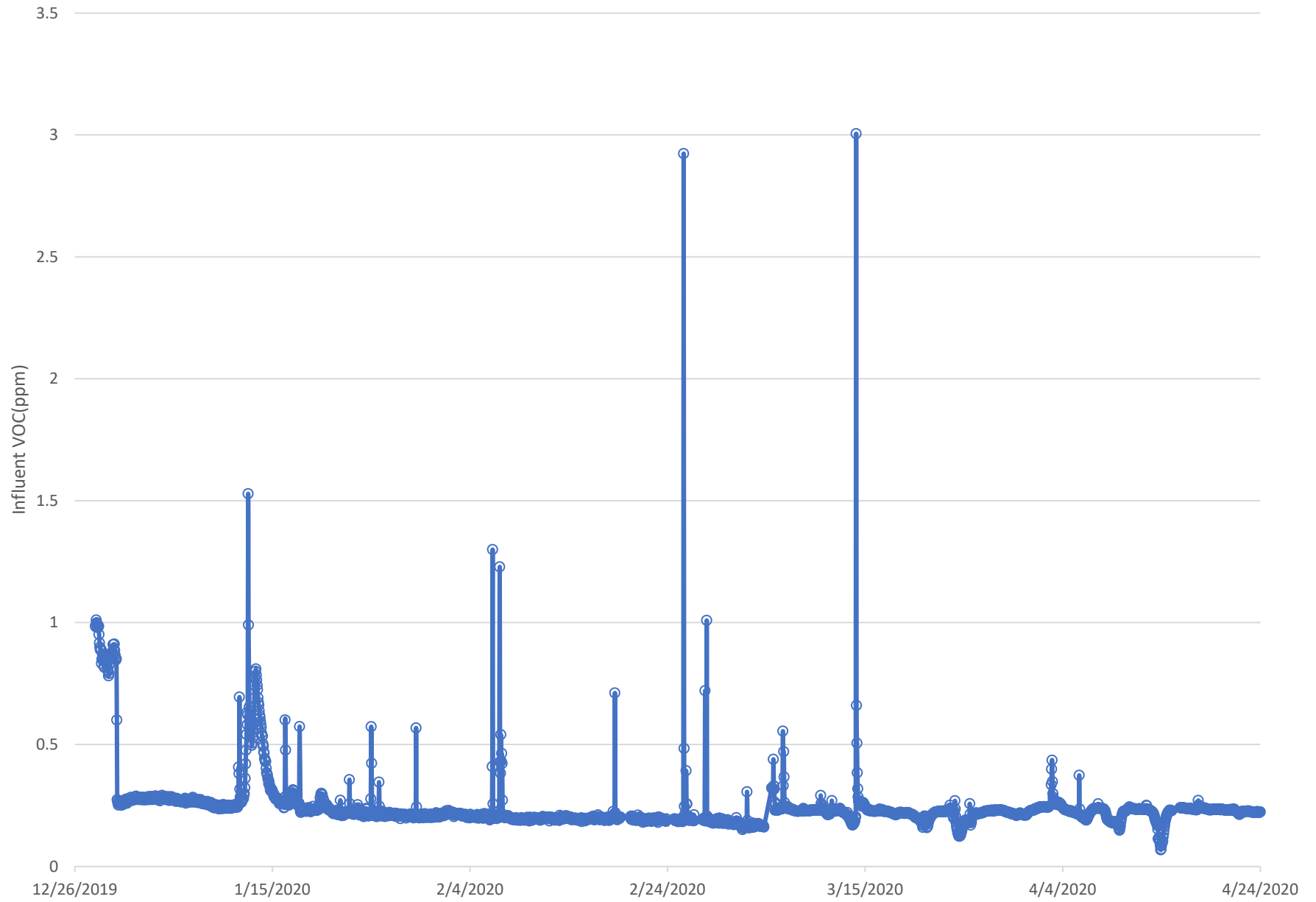
Drag the parameter(s) here

## Right Axis:

Drag the parameter(s) here



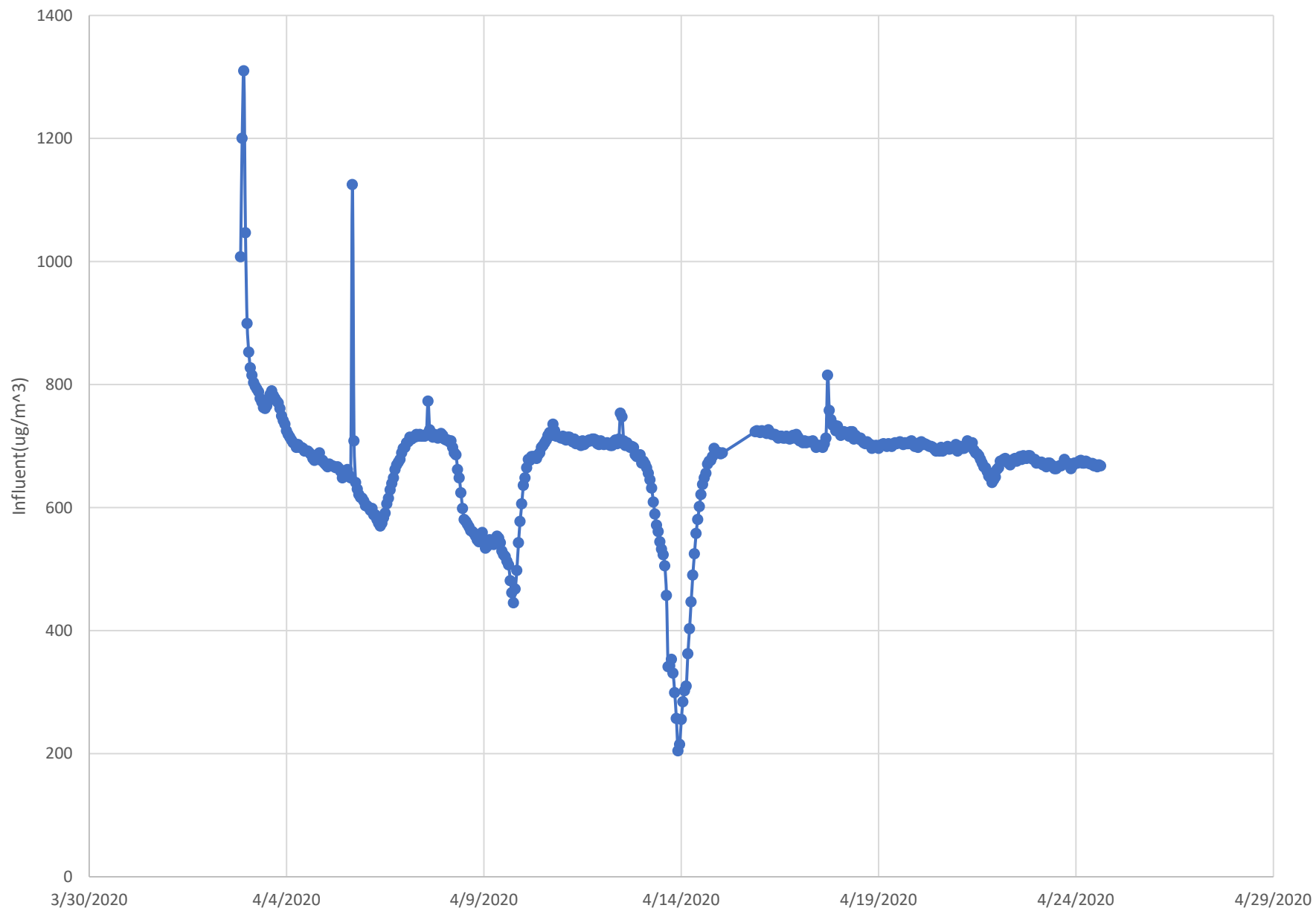
Influent VOC(ppm) 12/28/19- 4/24/20



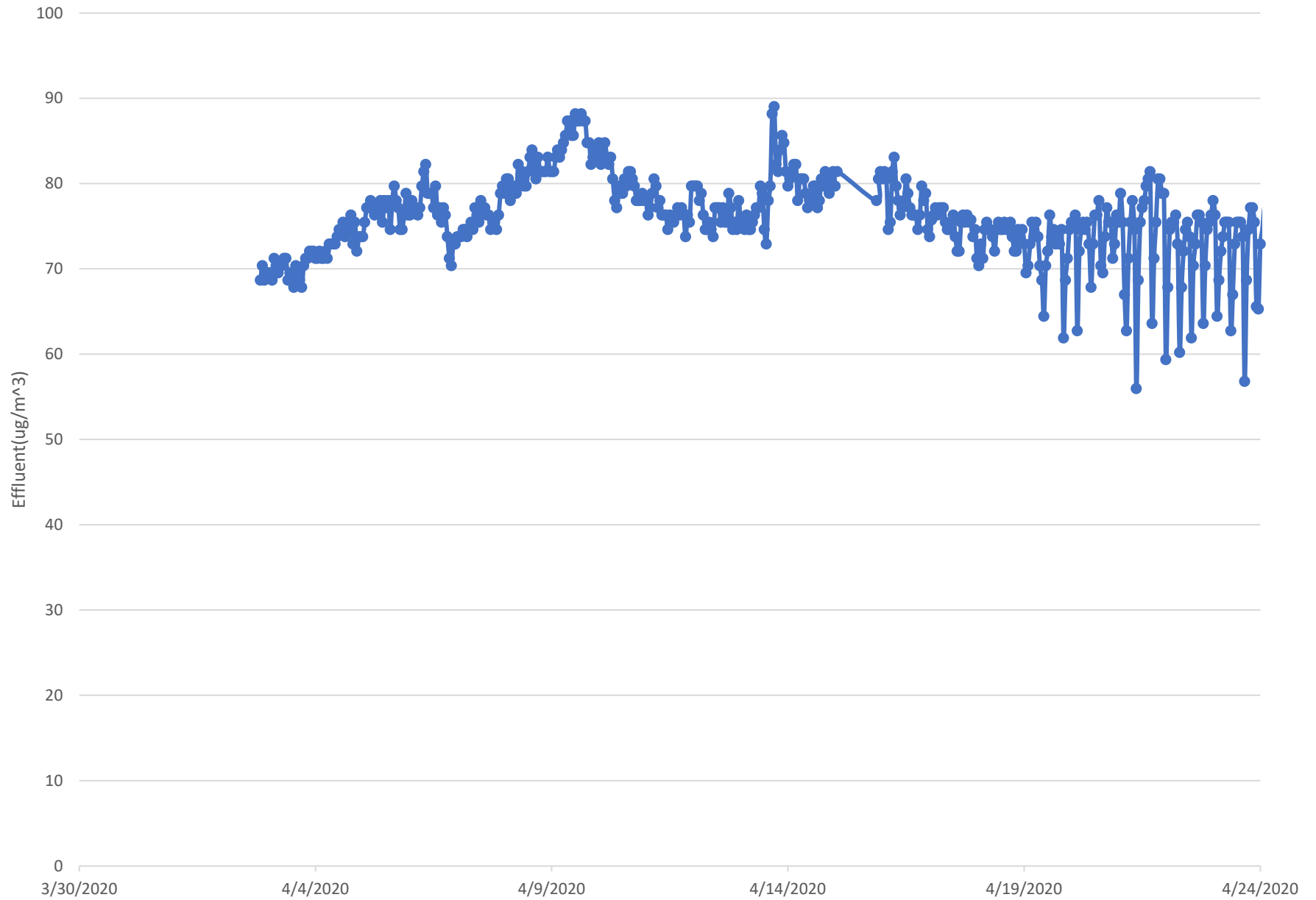
Effluent VOC(ppm) 12/28/19- 4/24/20



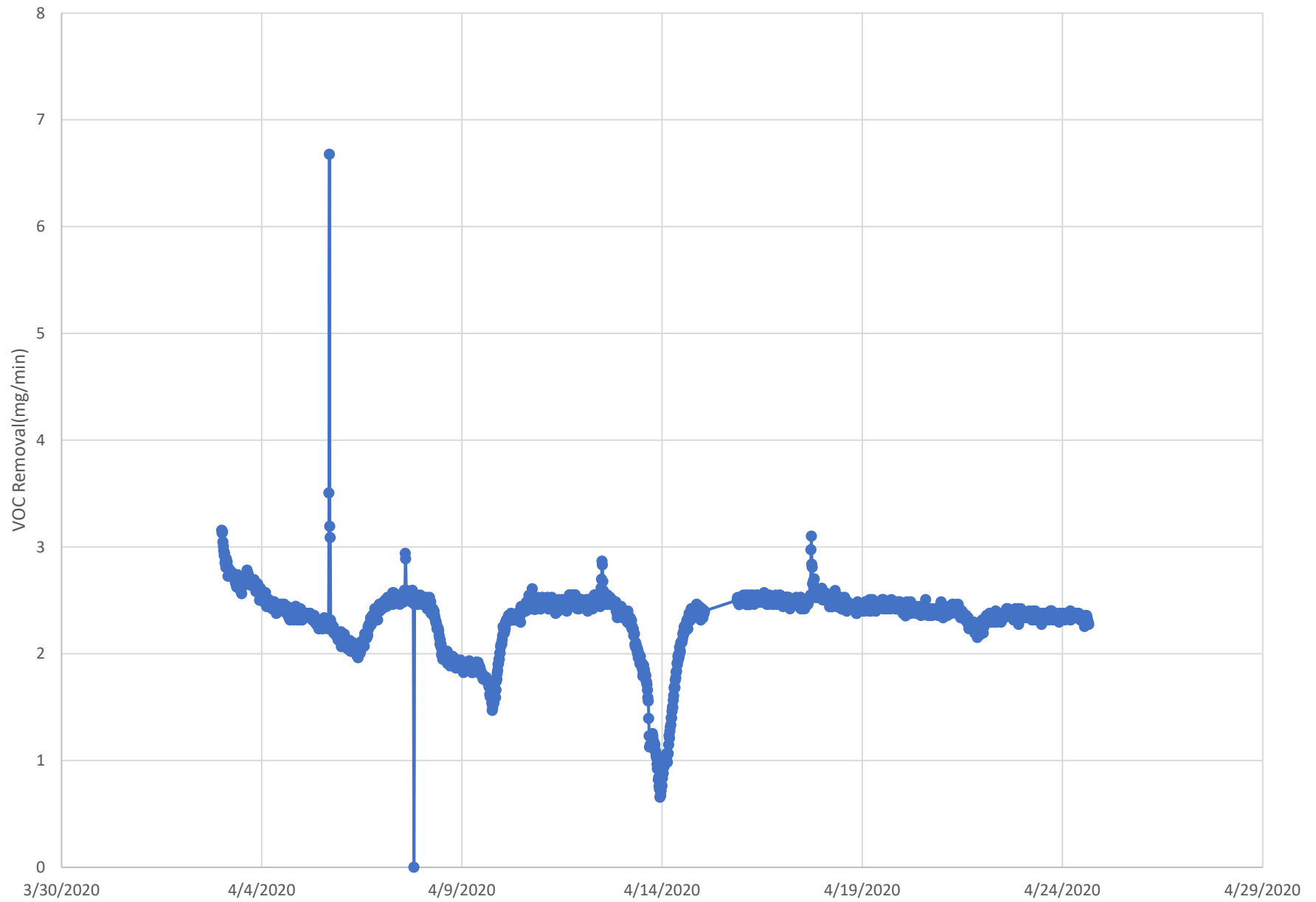
Influent( $\mu\text{g}/\text{m}^3$ ) 4/3/20-4/24/20



Effluent( $\mu\text{g}/\text{m}^3$ ) 4/3/20- 4/24/20



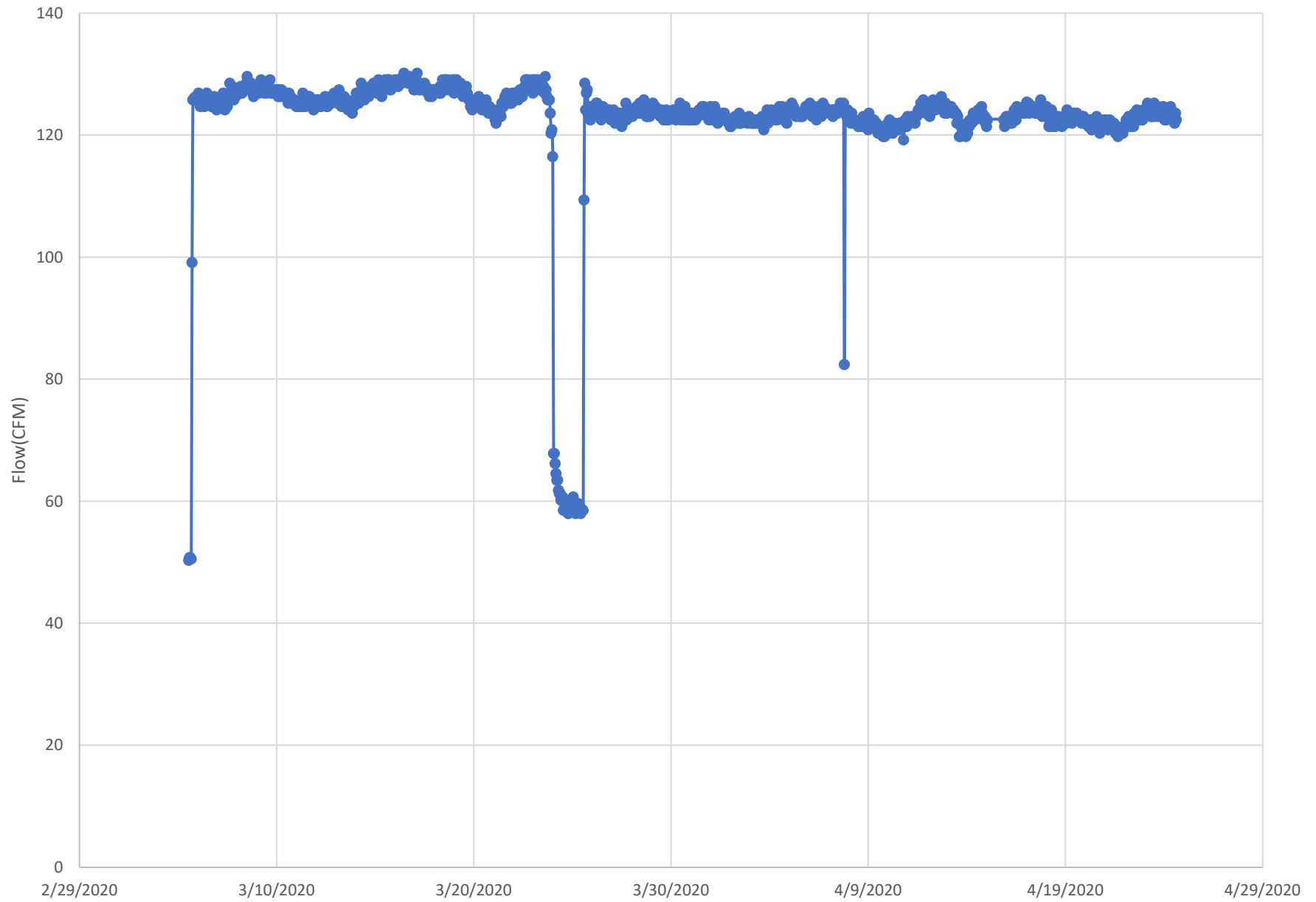
VOC Removal(mg/Min)4/3/20-4/24/20



Vacuum 3/5/20- 4/24/20

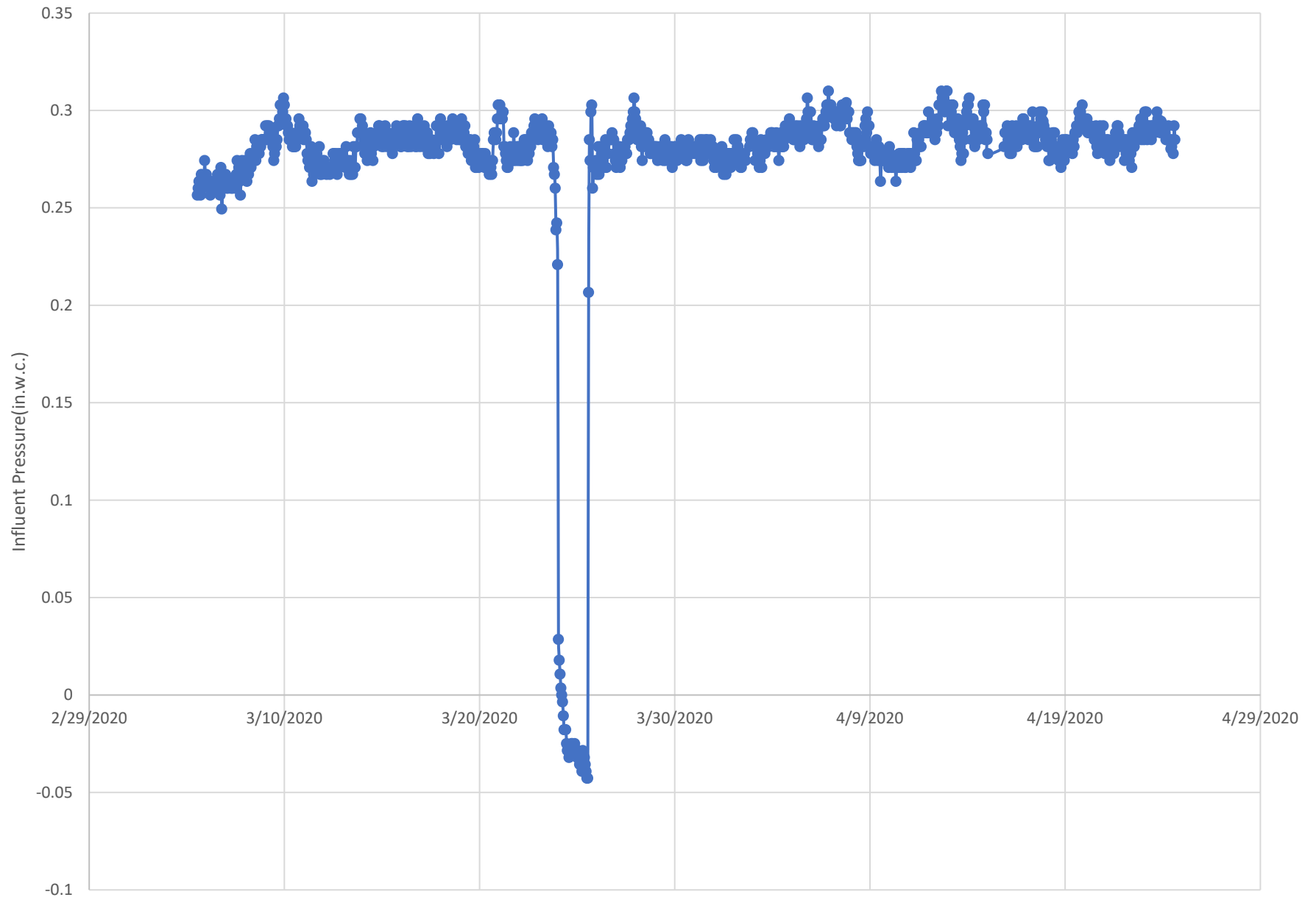


Flow(CFM) 3/5/20-4/24/20

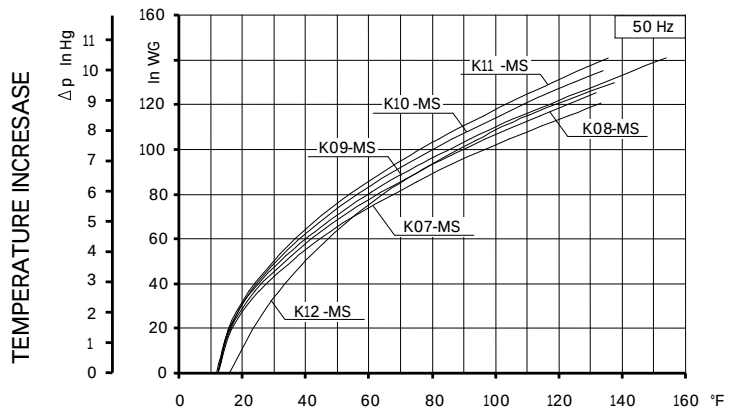
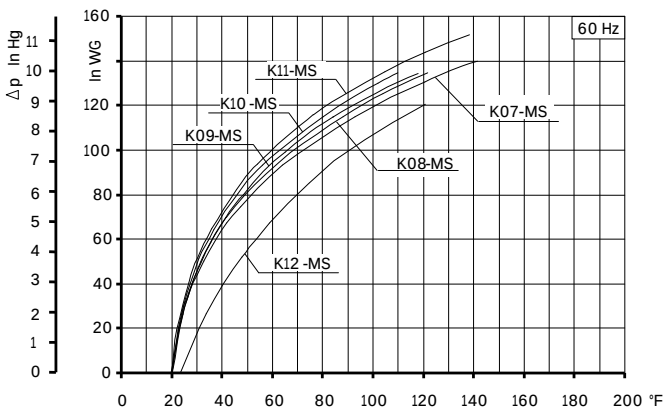
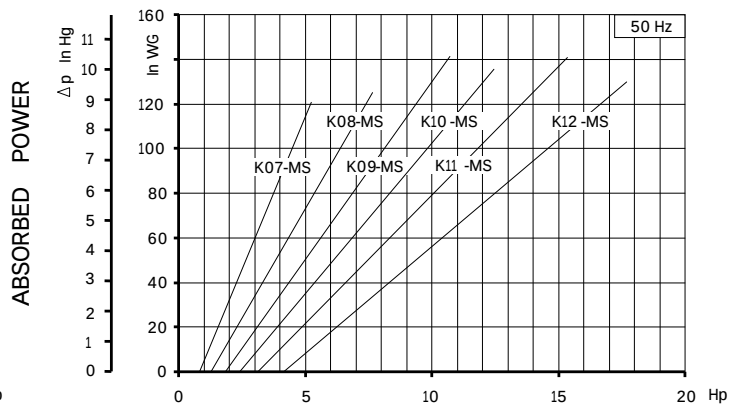
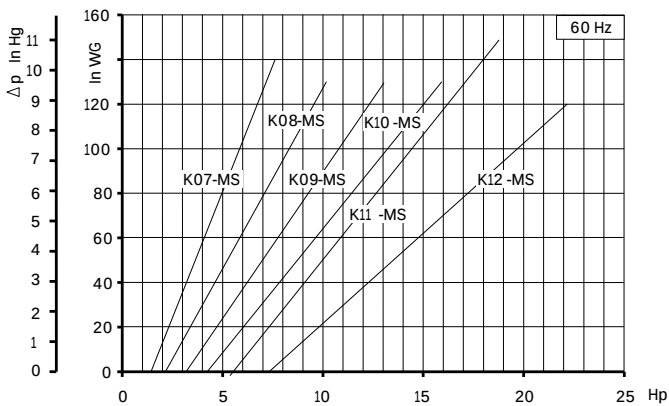
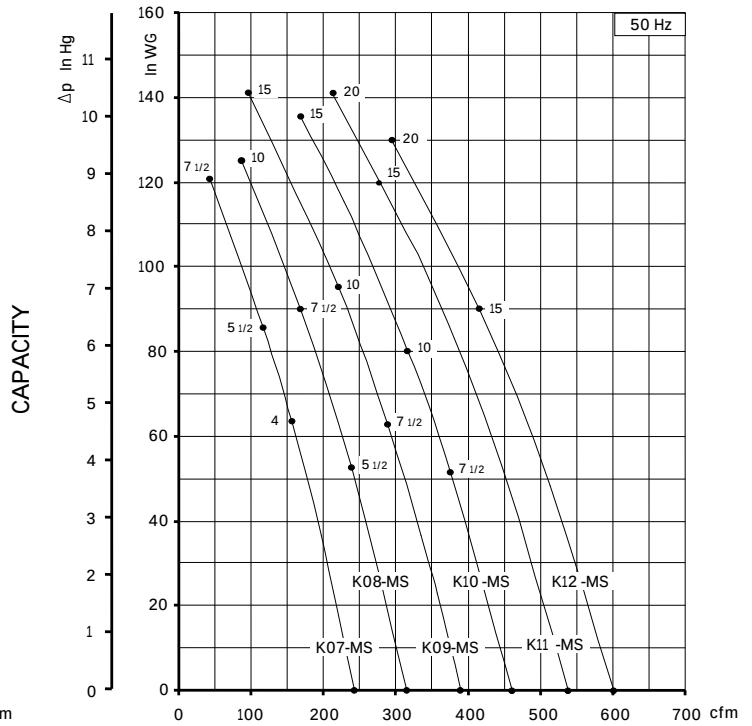
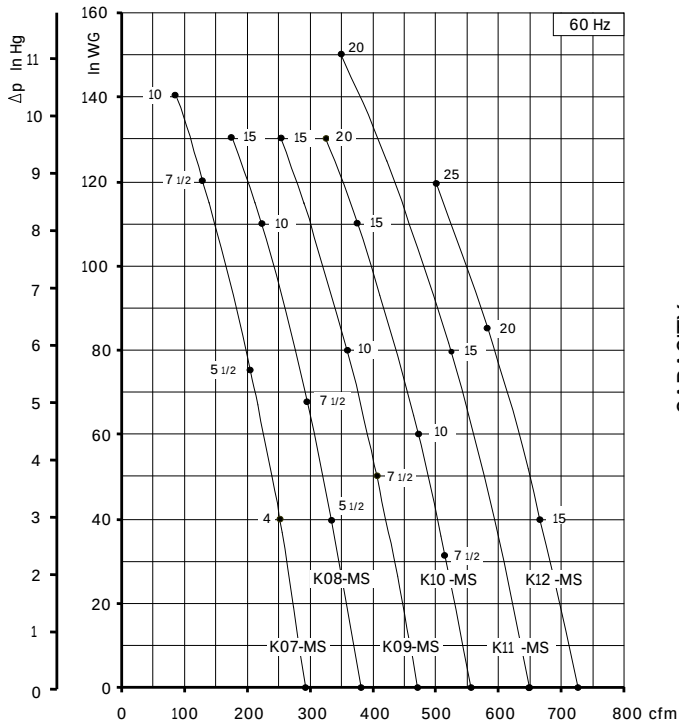




Influent Pressure(in.w.c.) 3/5/20-4/24/20

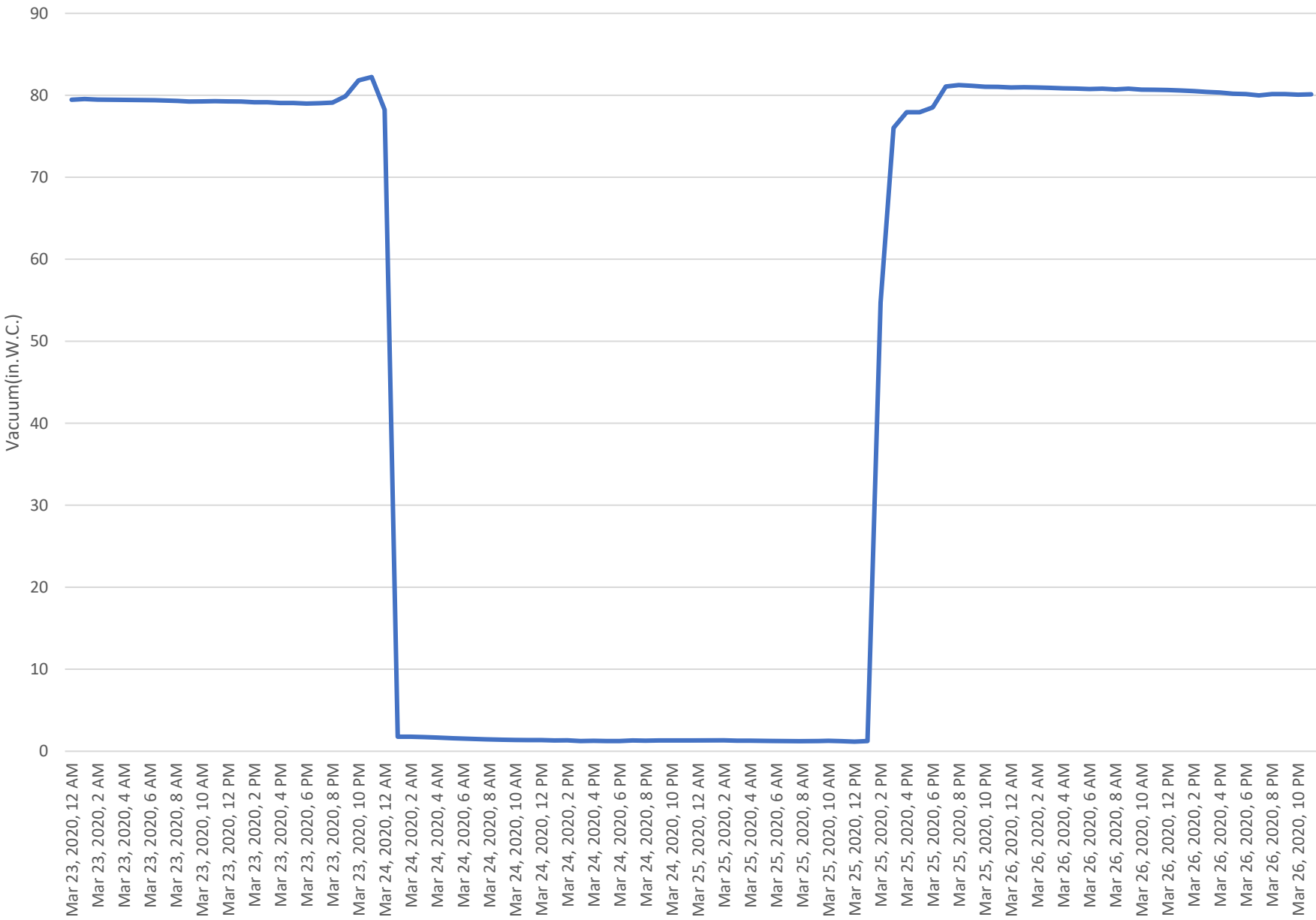


SCL K07 / K08 / K09 / K10 / K11 / K12  
MS SERIES  
SN 1810-19B 2/2

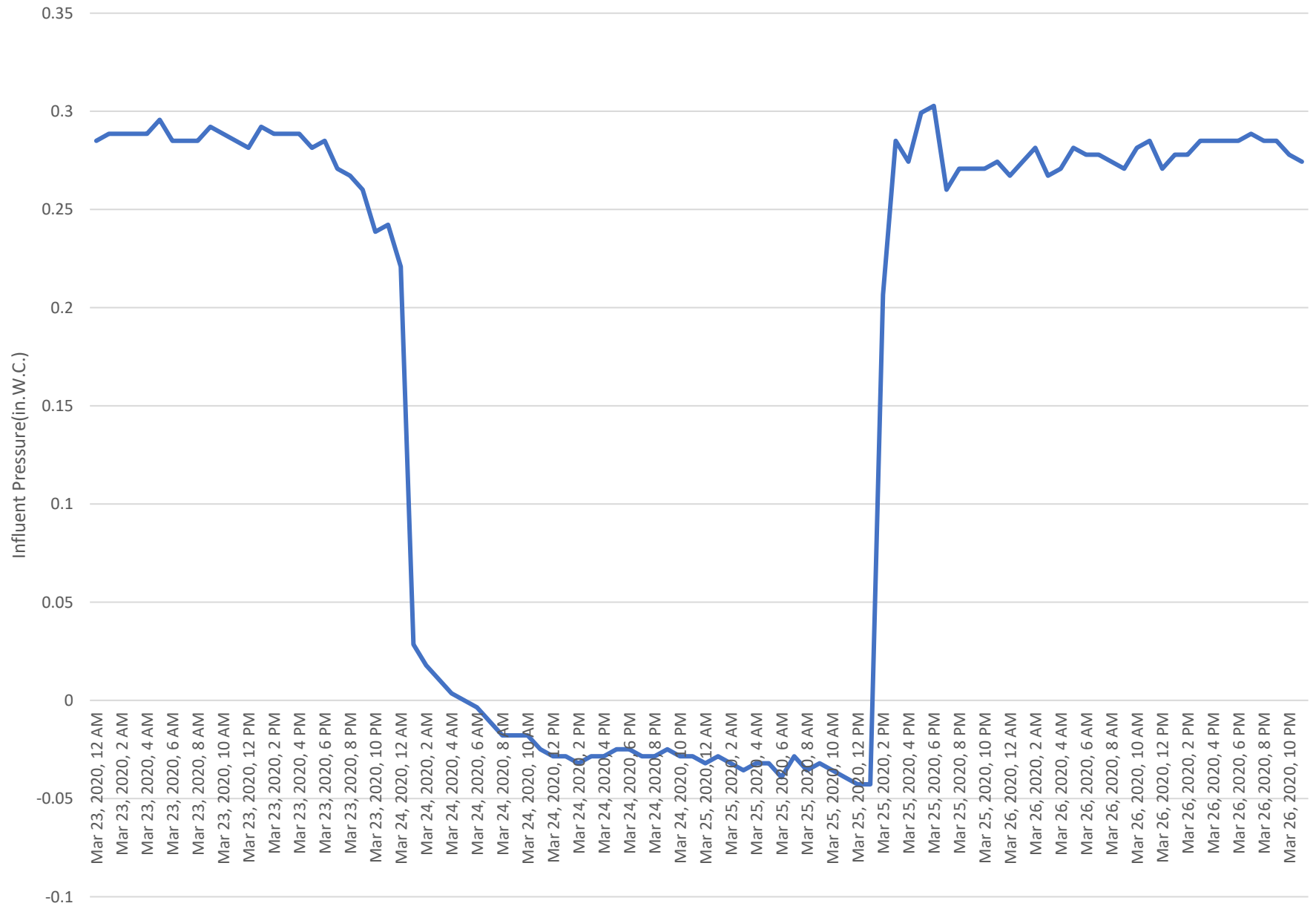


Curves refer to air at 68° F temperature, measured at inlet port and 29.92 In Hg atmospheric backpressure (abs).  
Values for flow, power consumption and temperature rise: +/-10% tolerance.  
Data subject to change without notice.

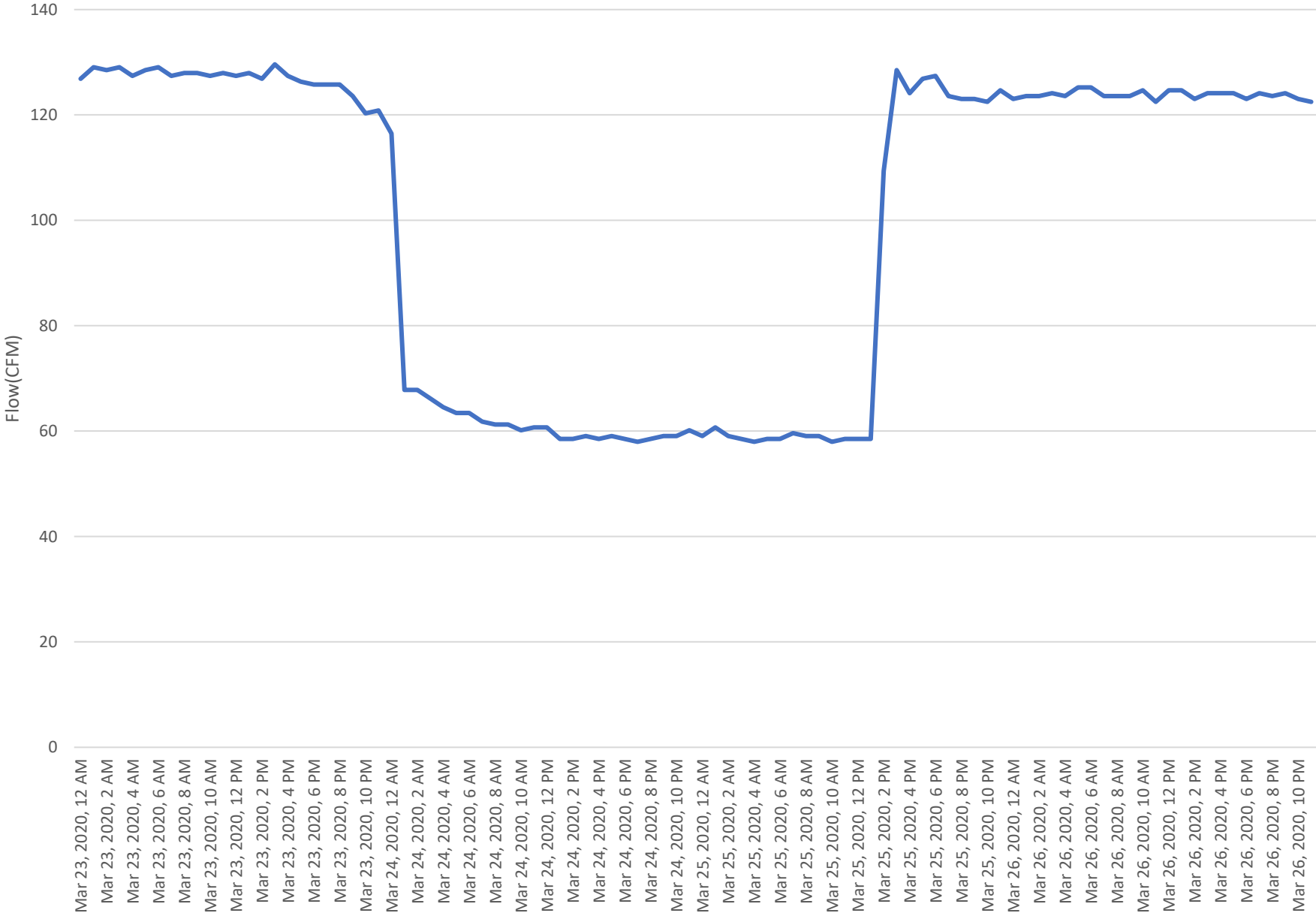
# Vacuum Shutoff



# Influent Pressure Shutoff



Flow Shutoff



## **Appendix A**

### **Site Management Plan**

**Williamsburg Bridgeview Apartments**  
**KINGS COUNTY**  
**BROOKLYN, NEW YORK**

---

# **SITE MANAGEMENT PLAN**

**NYSDEC Site Number: C224233**

**Prepared for:**

LPC Development Group LLC  
456 E 173<sup>rd</sup> Street  
Bronx, NY 10457

**Prepared by:**

Equity Environmental Engineering LLC  
500 International Drive  
Suite 150  
Mt. Olive, NJ 07828  
973/527-7451

**Revisions to Final Approved Site Management Plan:**

| <b>Revision No.</b> | <b>Date Submitted</b> | <b>Summary of Revision</b> | <b>NYSDEC Approval Date</b> |
|---------------------|-----------------------|----------------------------|-----------------------------|
|                     |                       |                            |                             |
|                     |                       |                            |                             |
|                     |                       |                            |                             |
|                     |                       |                            |                             |

---

**DECEMBER 2018**

## CERTIFICATION STATEMENT

I PETER JARAN certify that I am currently a NYS registered professional engineer as in defined in 6 NYCRR Part 375 and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and all activities were performed in full accordance with the DER-approved workplan and any DER-approved modification

 PE

DECEMBER 5, 2018 DATE



I ROBERT JACKSON certify that I am currently a Qualified Environmental Professional and that this Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and all activities were performed in full accordance with the DER-approved workplan and any DER-approved modification

 QEP

DECEMBER 5, 2018 DATE



## TABLE OF CONTENTS

### Williamsburg Bridgeview Apartments KINGS COUNTY BROOKLYN, NEW YORK

#### SITE MANAGEMENT PLAN

##### Table of Contents

| <u>Section</u> | <u>Description</u>                                            | <u>Page</u> |
|----------------|---------------------------------------------------------------|-------------|
| ES             | EXECUTIVE SUMMARY .....                                       | 1           |
| 1.0            | Introduction .....                                            | 1           |
| 1.1            | General .....                                                 | 1           |
| 1.2            | Revisions .....                                               | 2           |
| 1.3            | Notifications .....                                           | 3           |
| 2.0            | Summary of Previous Investigations and Remedial Actions ..... | 6           |
| 2.1            | Site Location and Description .....                           | 6           |
| 2.2            | Physical Setting .....                                        | 6           |
| 2.3            | Investigation and Remedial History .....                      | 7           |
| 2.4            | Decision Document.....                                        | 13          |
| 2.5            | Remaining Contamination.....                                  | 14          |
| 3.0            | Institutional and Engineering control plan.....               | 17          |
| 3.1            | General .....                                                 | 17          |
| 3.2            | Institutional Controls .....                                  | 17          |
| 3.3            | Engineering Controls.....                                     | 19          |
| 4.0            | Monitoring and sampling plan .....                            | 22          |
| 4.1            | General .....                                                 | 22          |
| 4.2            | Site – wide Inspection .....                                  | 23          |
| 4.3            | Treatment System Monitoring and Sampling.....                 | 24          |
| 4.4            | Post-Remediation Media Monitoring and Sampling .....          | 26          |
| 5.0            | Operation and maintenance plan .....                          | 30          |
| 5.1            | General .....                                                 | 30          |

|      |                                                  |    |
|------|--------------------------------------------------|----|
| 5.2  | Operations and Maintenance of SSDS and SVE ..... | 30 |
| 5.3  | Operation and Maintenance of SSDS.....           | 30 |
| 6.0  | Periodic Assessments/Evaluations .....           | 34 |
| 6.1  | Climate Change Vulnerability Assessment .....    | 34 |
| 6.2  | Green Remediation Evaluation.....                | 35 |
| 6.3  | Remedial System Optimization .....               | 37 |
| 7.0. | Reporting Requirements.....                      | 39 |
| 7.1  | Site Management Reports.....                     | 39 |
| 7.2  | Periodic Review Report.....                      | 41 |
| 7.3  | Corrective Measures Work Plan.....               | 45 |
| 7.4  | Remedial Site Optimization Report.....           | 45 |
| 8.0  | References .....                                 | 47 |

## **Figures**

---

1. Site Location Map
2. Site Map
3. Tax Map
4. Remaining Soil Sample Exceedances
5. Groundwater Tag Map
6. Proposed Monitoring Well Locations
7. Soil Vapor Sample Exceedances
8. Engineering Controls Location

## **Tables**

---

1. Notifications
2. Remaining Soil Sample Exceedances
3. Remaining Groundwater Exceedances
4. Remaining Soil Vapor Exceedance
5. Remedial System Monitoring Requirements and Schedule
6. Remedial System Sampling Requirements and Schedule
7. Post Remediation Sampling Requirements and Schedule
8. Schedule of Interim Monitoring/Inspection Reports

## **Appendices**

---

- A. Easement
- B. Contacts
- C. Soil Boring Logs
- D. Well Construction Logs
- E. Excavation Workplan
- F. HASP & CAMP
- G. O&M Manuals
- H. QAPP
- I. Site Management Forms
- J. Field Sampling Plan
- K. Remedial System Optimization Table of Contents
- L. Permits and/or Permit Equivalent
- M. Responsibilities of the Owner/Remedial Party

## **List of Acronyms**

|        |                                                                      |
|--------|----------------------------------------------------------------------|
| ASP    | Analytical Services Protocol                                         |
| BCA    | Brownfield Cleanup Agreement                                         |
| BCP    | Brownfield Cleanup Program                                           |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CAMP   | Community Air Monitoring Plan                                        |
| C/D    | Construction and Demolition                                          |
| CFR    | Code of Federal Regulation                                           |
| CLP    | Contract Laboratory Program                                          |
| COC    | Certificate of Completion                                            |
| CP     | Commissioner Policy                                                  |
| DER    | Division of Environmental Remediation                                |
| EC     | Engineering Control                                                  |
| ECL    | Environmental Conservation Law                                       |
| ELAP   | Environmental Laboratory Approval Program                            |
| ERP    | Environmental Restoration Program                                    |
| EWP    | Excavation Work Plan                                                 |
| HASP   | Health and Safety Plan                                               |
| IC     | Institutional Control                                                |
| NYSDEC | New York State Department of Environmental Conservation              |
| NYSDOH | New York State Department of Health                                  |
| NYCRR  | New York Codes, Rules and Regulations                                |
| O&M    | Operation and Maintenance                                            |
| OM&M   | Operation, Maintenance and Monitoring                                |
| OSHA   | Occupational Safety and Health Administration                        |
| PID    | Photoionization Detector                                             |
| PRP    | Potentially Responsible Party                                        |
| PRR    | Periodic Review Report                                               |
| QA/QC  | Quality Assurance/Quality Control                                    |
| QAPP   | Quality Assurance Project Plan                                       |
| RAO    | Remedial Action Objective                                            |
| RAWP   | Remedial Action Work Plan                                            |
| RCRA   | Resource Conservation and Recovery Act                               |
| RI/FS  | Remedial Investigation/Feasibility Study                             |
| ROD    | Record of Decision                                                   |
| RP     | Remedial Party                                                       |
| RSO    | Remedial System Optimization                                         |
| SAC    | State Assistance Contract                                            |
| SCG    | Standards, Criteria and Guidelines                                   |
| SCO    | Soil Cleanup Objective                                               |
| SMP    | Site Management Plan                                                 |
| SOP    | Standard Operating Procedures                                        |
| SOW    | Statement of Work                                                    |
| SPDES  | State Pollutant Discharge Elimination System                         |

|       |                                               |
|-------|-----------------------------------------------|
| SSD   | Sub-slab Depressurization                     |
| SVE   | Soil Vapor Extraction                         |
| SVI   | Soil Vapor Intrusion                          |
| TAL   | Target Analyte List                           |
| TCL   | Target Compound List                          |
| TCLP  | Toxicity Characteristic Leachate Procedure    |
| USEPA | United States Environmental Protection Agency |
| UST   | Underground Storage Tank                      |
| VCA   | Voluntary Cleanup Agreement                   |
| VCP   | Voluntary Cleanup Program                     |

**ES EXECUTIVE SUMMARY**

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan:

Site Identification: C224233  
 Williamsburg Bridgeview Apartments  
 95-105 South 5<sup>th</sup> Street  
 Brooklyn, NY 11249

|                                  |                                                                                         |
|----------------------------------|-----------------------------------------------------------------------------------------|
| Institutional Controls:          | 1. The property may be used for restricted residential, commercial, and industrial use. |
|                                  | 2. Property Environmental Easement                                                      |
|                                  | 3. All ECs must be inspected at a frequency and in a manner defined in the SMP.         |
| Engineering Controls:            | 1. Cover system                                                                         |
|                                  | 2. Sub-slab depressurization system (SSDS)                                              |
|                                  | 3. Soil Vapor Extraction System (SVE)                                                   |
| Inspections:                     | Frequency                                                                               |
| 1. Cover inspection              | Annually                                                                                |
| Monitoring:                      |                                                                                         |
| 1. SSDS                          | Quarterly                                                                               |
| 2. SVE                           | Monthly                                                                                 |
| 3. Groundwater Monitoring        | Annually                                                                                |
| Maintenance:                     |                                                                                         |
| 1. Exhaust Fan maintenance       | Quarterly                                                                               |
| 2. SVE Package Plant maintenance | Semi-annually                                                                           |
| 2. SVE Carbon Canister exchange  | As required                                                                             |

Site Identification: C224233  
Williamsburg Bridgeview Apartments  
95-105 South 5<sup>th</sup> Street  
Brooklyn, NY 11249

|                           |             |
|---------------------------|-------------|
| Reporting:                |             |
| 1. Inspections reports    | As required |
| 2. Periodic Review Report | Annually    |

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.



## **1.0 INTRODUCTION**

### **1.1 General**

This Site Management Plan (SMP) is a required element of the remedial program for the Williamsburg Bridgeview Apartments located in Brooklyn, New York (hereinafter referred to as the “Site”). See Figure 1. The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP) Site No. C224233 which is administered by New York State Department of Environmental Conservation (NYSDEC).

LPC Development Group LLC (LPC) entered into a Brownfield Cleanup Agreement on June 24, 2016 with the NYSDEC to remediate the site. The site location and boundaries are provided in Figure 2. The boundaries of the site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix A.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as “remaining contamination”. Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with The Office of the City Register of the City of New York.

This SMP was prepared to manage remaining contamination at the site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor’s successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375, the BCA, Site #C223233, for the site, and thereby subject to applicable penalties.
- Should a building foundation or slab be removed from the property, a cover system consistent with that described in the September 2017 Decision Document will be placed in any areas where the upper two feet of exposed surface soil exceed the applicable soil cleanup objectives (SCOs).

All reports associated with the site can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the site is provided in Appendix B of this SMP.

This SMP was prepared by Equity Environmental Engineering LLC (Equity), on behalf of LPC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated August, 2018, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the site. The Office of the City Registry of New York is the recording entity.

## **1.2 Revisions**

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Environmental Easement for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

### 1.3 Notifications

Notifications will be submitted by the property owner to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the VCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the BCA, and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 on the following page includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

**Table 1: Notifications\***

| Name                                            | Contact Information                                                                                                                                                                                                     |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NYSDEC Project Manager – Melissa Sweet          | (518) 402-9614<br>New York State Department of Environmental Conservation<br>625 Broadway, Albany, NY 12233-7015<br><a href="mailto:melissa.sweet@dec.ny.gov">melissa.sweet@dec.ny.gov</a>                              |
| NYSDEC Regional HW Engineer – Jane O<br>Connell | Jane O'Connell 718-482-4995<br>New York State Department of Environmental Conservation<br>47-40 21st Street Long Island City, NY 11101-5401<br><a href="mailto:jane.oconnell@dec.ny.gov">jane.oconnell@dec.ny.gov</a> ; |
| NYSDEC Site Control – Kelly Lewandowski         | Kelly Lewandowski (518)402-9553<br>New York State Department of Environmental Conservation<br>625 Broadway, Albany, NY 12233-7015<br><a href="mailto:Kelly.lewandowski@dec.ny.gov">Kelly.lewandowski@dec.ny.gov</a> ,   |

\* Note: Notifications are subject to change and will be updated as necessary.

## **2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS**

### **2.1 Site Location and Description**

The site is located in Brooklyn, Kings County, New York and is identified as Block 2443 and Lot 6 (formerly lots 6, 37, and 41) on the Williamsburg Tax Map (see Figure 3). The site is an approximately one-third-acre area and is bounded by Berry Street to the north, residential property to the east, commercial property to the west, and South 5th Street to the south (see Figure 2 – Site Map). The boundaries of the site are more fully described in Appendix A –Environmental Easement. The Beneficial Owner of the site parcel at the time of issuance of this SMP is LPC Development Group, LLC (LPC). On June 29, 2016 the Property was deeded from the City of New York to LPC Development Group LLC which Property was then immediately deeded from LPC Development Group LLC to Williamsburg Bridgeview Apartments Housing Development Fund Corporation. The Property was simultaneously encumbered by a Declaration of Interest and Nominee Agreement which provides LPC Development Group LLC with the beneficial interest in the Property and keeps the legal fee interest in the Property with Williamsburg Bridgeview Apartments Housing Development Fund Corporation.

LPC Development Group, as the beneficial owner of the Property has all control over the Property.

### **2.2 Physical Setting**

#### **2.2.1 Land Use**

The Site, prior to redevelopment, consisted of an abandoned warehouse and undeveloped land. The Site is zoned as manufacturing with a residential overlay (M1-2/R6) designation and is currently has an 11-story residential building with limited parking. Site occupants will include the building residents, and future community or commercial uses.

The properties adjoining the Site, and in the neighborhood of the Site, primarily include commercial and residential mixed-use properties. The properties immediately south of the entire Site include South 5<sup>th</sup> Street and the Williamsburg Bridge underpass; the properties immediately north of the Site include residential properties; the properties immediately east of the Site include commercial and residential properties; and the properties to the west of the Site include residential properties.

### 2.2.2 Geology

Fill material was observed throughout all borings at different depths between 0-5 feet bgs. Soils consisted of well-graded sand with silt (ranging from fine to coarse sands) and well well-graded sand (ranging from fine to coarse). Small to large sized gravel and cobbles were observed throughout all borings. Bedrock was encountered at 39 feet bgs at MW-3, 42 feet bgs at MW-2 and 27 feet bgs at MW-4. Bedrock was not encountered in MW-1 which suggests that bedrock slopes downward to the north with the topography towards the East River. Groundwater was encountered at all wells at approximately 45-47 feet bgs.

Soil boring logs are provided in Appendix C.

### 2.2.3 Hydrogeology

Groundwater was encountered at approximately 45 below ground surface (bgs) in the three monitoring wells (MW-1, MW-2, MW-3, and MW-4) installed during the remedial investigation. Groundwater flow is generally west towards the East River. There are no known private or public water supply wells in the area. Groundwater monitoring well construction logs for the remedial investigation are provided in Appendix D. Groundwater monitoring construction logs for the permanent wells will be provided when available.

## **2.3 Investigation and Remedial History**

Former lot 6 was owned by the city of New York. On June 29, 2016 the Property was deeded from the City of New York to LPC Development Group LLC which Property was then immediately deeded from LPC Development Group LLC to Williamsburg Bridgeview Apartments Housing Development Fund Corporation. The Property was

simultaneously encumbered by a Declaration of Interest and Nominee Agreement which provides LPC Development Group LLC with the beneficial interest in the Property and keeps the legal fee interest in the Property with Williamsburg Bridgeview Apartments Housing Development Fund Corporation.

LPC Development Group, as the beneficial owner of the Property has all control over the Property.

Prior to the Ownership the New York City Landmarks Preservation Commission (LPC) started an architectural salvage program at the warehouse on the Site in 1980 to reuse discarded elements from buildings throughout the City. Salvaged items such as doors, windows, fences, and decorative elements, were sold to the public at low rates to restore historic buildings. The program ended in 2000 due to budgetary constraints. In the 2005 Greenpoint-Williamsburg Points of Agreement, the City identified this Site as a location for future affordable housing development.

Former lots 37 and 41 were originally housed with two story residential buildings from ca. 1868. They were connected to the sewer system probably in the same year or shortly before. Lot 37 was originally divided into 3 lots (37, 38 and 39). According to the Archaeological Field Investigation that was completed by Historical Perspectives in July 2015 on behalf of the Applicant, lots 37 and 39 do not have any history of the owner living at the address and therefore not possible to trace the building's history of occupation. Former lot 38 was a two and a half story building owned by David Downing and occupied by an engineer named Daniel Downing in the late 1800's. There is no further history on NYC ACRIS in regards to subsequent ownership except for the foreclosure of a tax lien from the Commissioner of Finance conveyed to The City of New York on May 28, 1986.

Pursuant to NYC ACRIS lot 41 was previously owned by Ellen L. Goodrich and Leo W. Goodrich and conveyed to William and Clarence Goodrich on May 4, 1925. On November 21, 1972, both William and Clarence Goodrich then conveyed property to Eleanora Donop. Subsequently, in an action to foreclose certain tax liens owned and held



by the City of New York the Commissioner of Finance also conveyed lot 41 to The City of New York on May 28, 1986.

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the Site. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

A Phase I Environmental Site Assessment was completed on 8/20/13 by Hillmann Consulting LLC.

A Phase II was conducted onsite in multiple phases from October 2015 and January 2016 and evaluated the onsite contamination in soil, soil vapor, and groundwater. It also included the offsite vapor intrusion investigation. It was the basis for an Interim Remedial Workplan (IRMWP). The following is a summary of the Phase II investigation:

1. Elevation of the property is approximately 45 feet above mean sea level and is relatively flat.
2. Depth to groundwater is approximately 45 feet bgs at the Site.
3. Groundwater flow is generally west beneath the Site.
4. Depth to bedrock is at approximately 40 feet bgs.
5. The stratigraphy of the site, from the surface down, consists of 2-11 feet of urban fill material underlain by varying thicknesses of well graded sand/silt (fine to medium sand) and well graded fine grain sand. Several of the borings; SB-1, SB-4, SB-5, and SB-7 contained medium grain sand and gravel. In borings SB-4 through SB-7, refusal was encountered at approximately 20 feet.
6. Soil/fill samples collected during the RI were compared to New York State Department of Environmental Conservation (NYSDEC) Part 375 Table 375-6.8 Unrestricted Use, Restricted Residential Use, and Protection of Groundwater Soil Cleanup Objectives (SCOs). Several Volatile Organic Compounds (VOCs) were detected. tetrachloroethene

(PCE) and trichloroethene (TCE) were each detected in the shallow (0-2 foot interval) soil samples under the existing building with PCE detected at a maximum concentration of 0.0031 milligrams per kilogram [mg/kg] and TCE detected at a maximum concentration of 0.0073 mg/kg. The additional shallow soil sampling performed in the existing building showed PCE detected at a maximum of 0.0037 mg/kg and TCE detected at a maximum of 0.0081 mg/kg. Acetone, methylene chloride, and benzene in two shallow soil samples, and toluene in one deep soil sample were also detected but below Unrestricted Use SCOs. Several Semi-Volatile Organic Compounds (SVOCs) were detected in the samples; however, the only SVOCs detected above the Restricted Residential Use SCOs were benzaldehyde (maximum [max] 1.39 mg/kg), benzo(a)anthracene (max 1.25 mg/kg), benzo(a)pyrene (max 1.62 mg/kg), and indeno(1,2,3-cd)pyrene (max 0.957 mg/kg) in two shallow soil (0-2 foot interval) samples. The pesticides dieldrin (max. 0.0092 mg/kg), 4, 4'-DDD (0.0038 mg/kg), and 4, 4'-DDT (max 0.0369 mg/kg) were only detected within shallow (0-2 foot interval) soil samples above Unrestricted Use SCOs. Total PCBs were detected in one shallow (0-2 foot interval) soil sample at 0.496 mg/kg, above Unrestricted Use SCO but below the Restricted Residential Use SCO. The metals copper (max. 50.4 mg/kg), iron (max. 23,100 mg/kg), lead (max. 392 mg/kg), mercury (max. 0.97 mg/kg) and zinc (max. 184 mg/kg) were detected above Unrestricted Use SCOs. Of these metals, mercury exceeded Restricted Residential SCO in one shallow (0-2 foot) soil sample at SB-1.

Three samples contained concentrations of contaminants above the Protection to Groundwater criteria. Benzo(a)anthracene and chrysene were detected above the criteria of 1.0 mg/kg in SB-5 and SB-7 at the 0-2 foot interval. The maximum concentration of both SVOCs was detected in SB-5 at 1.39 and 1.31 mg/kg respectively. Mercury was detected in SB-1 from 0-2 feet at 0.97 mg/kg and the criteria is 0.73 mg/kg.

The samples collected in July 2016, did not contain any contaminants above the various regulatory criteria used to evaluate soil onsite. Waste classification soil samples collected indicated several SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd) pyrene above the unrestricted and/or restricted residential criteria in WC-1. WC-1 contained dieldrin and 4, 4'-DDT above the unrestricted criteria. WC-1 contained lead, mercury and zinc and WC-2 contained lead above the unrestricted criteria.

The suspected and most likely source of the soil contamination across the site is historic fill and releases from past commercial operations of the site. The historic use of the three underground storage tanks (USTs) may have contributed to some of the contamination detected near the Berry Street entrance.

7. Groundwater samples collected during the RI were compared to the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (GQS) for Class GA (drinking water). The VOC PCE (max. 71.4 micrograms per liter [ $\mu\text{g/L}$ ]) was detected above GQS in all four groundwater samples and TCE (max. 27.2  $\mu\text{g/L}$ ) was detected above GQS in three groundwater samples. One SVOC, bis(2-ethylhexyl)phthalate (max. 3.8  $\mu\text{g/L}$ ) was detected in the groundwater, but at a concentration below GQS. The metals iron, manganese, selenium, and sodium were detected at concentrations above the GQS in the unfiltered samples with manganese (max. 0.849 mg/L), sodium (max. 122 mg/L), and selenium (0.012 mg/L) detected at concentrations above the GQS in the filtered samples. No PCBs or pesticides were detected. Groundwater was encountered at approximately 45 feet deep. As noted in Section 5 below, the source of contamination to the groundwater appears to be from an offsite, up-gradient source.
8. Soil vapor samples collected at a depth of 10 feet below grade during the RI were collected to determine the presence of contamination and whether mitigation measures would be necessary as part of the remedial program and redevelopment project. The samples indicated the presence of petroleum related VOCs and chlorinated VOCs. Petroleum-related VOCs (BTEX) were detected at a maximum concentration of 79 micrograms per cubic meter [ $\mu\text{g/m}^3$ ] in SG-5. Overall the highest reported concentration was for acetone (208  $\mu\text{g/m}^3$ ), 1, 1-dichloroethylene (181  $\mu\text{g/m}^3$ ), cis-1, 2-dichloroethylene (233  $\mu\text{g/m}^3$ ), heptane (142  $\mu\text{g/m}^3$ ), hexane (277  $\mu\text{g/m}^3$ ), propylene (3,990  $\mu\text{g/m}^3$ ), 2, 2, 4-trimethylpentane (377  $\mu\text{g/m}^3$ ), and trichlorofluoromethane (116  $\mu\text{g/m}^3$ ). Carbon tetrachloride was detected in two samples at a maximum concentration of 2.6  $\mu\text{g/m}^3$ . 1,1,1-trichloroethane (TCA) was detected in all six soil vapor samples. trichloroethene (TCE) was detected in all of the soil vapor samples with concentrations of 21  $\mu\text{g/m}^3$ , 21  $\mu\text{g/m}^3$ , 135  $\mu\text{g/m}^3$ , 688  $\mu\text{g/m}^3$ , 1,980  $\mu\text{g/m}^3$ , and 3,510  $\mu\text{g/m}^3$ . tetrachloroethene (PCE) was also detected in all soil vapor samples at four locations with concentrations of 142  $\mu\text{g/m}^3$ , 656  $\mu\text{g/m}^3$ , 739  $\mu\text{g/m}^3$ , and 2,870  $\mu\text{g/m}^3$ . The five additional sub-slab soil vapor samples taken within the existing building at a depth of 0-2 feet and detected PCE at a maximum concentration of 5.8  $\mu\text{g/m}^3$  and TCE with a

maximum concentration of 31  $\mu\text{g}/\text{m}^3$ . TCA was not detected in the sub-slab soil vapor samples.

The exact source of the soil-vapor contaminants remains uncertain as the onsite groundwater is over 40 feet below grade and the contaminants detected in the site soil do not correlate well with the detection of contaminants in soil-vapor. Based upon site conditions evaluated during the RI, the most likely source of the soil-vapor contaminants may be the several USTs found near the Berry Street entrance to the site and adjacent to the eastern end of the former warehouse building. Although post-excavation soil samples from these USTs did not reflect significant contaminant releases, the presence and historic use of the USTs is a suspected source.

The IRMWP covered the design for the soil excavation, the design and installation of the Sub-Slab Depressurization System (SSDS), and the design of the Soil Vapor Extraction (SVE) system. The IRMWP was completed in August 2016.

A Preliminary Phase II Investigation Report was prepared and submitted to the DEC in November 2016.

During the implementation of the IRM, five (5) underground storage tanks (USTs) were discovered onsite at various times throughout 2017. The USTs were properly cleaned out, disposed of, and the disposition recorded with the DEC. The reports on the UST closures were included in the Construction Closure Report (CCR).

A CCR was prepared to document the implementation of the IRM. The final version of the CCR was completed in March 2018.

A Remedial Action Workplan (RAWP) prepared to address the onsite vapor intrusion issues. The RAWP was completed in May 2017 and approved by the DEC in September 2017. It consisted of the installation of a Sub-Slab Depressurization System (SSDS) under the building and its operation to prevent vapor intrusion into the onsite building and a Soil Vapor Extraction System (SVE) to prevent offsite migration of vapors for the western end of the parking lot. The systems were installed in accordance with the approved RAWP during construction. They were completed in November 2018.

Additional details of the SSDS and SVE are provided in Appendix G and in the Final Engineering Report (FER).

## **2.4 Decision Document**

### **Remedial Action Objectives**

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated September 27, 2018, are as follows:

#### **Groundwater**

##### **RAOs for Public Health Protection**

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles from contaminated groundwater.

#### **Soil**

##### **RAOs for Public Health Protection**

- Prevent ingestion/direct contact with contaminated soil.
- Prevent inhalation of or exposure from contaminants volatilizing from contaminants in soil.

##### **RAOs for Environmental Protection**

- Prevent migration of contaminants that would result in groundwater or surface water contamination.

#### **Soil Vapor**

##### **RAOs for Public Health Protection**

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings at a site.

## 2.5 Remaining Contamination

### Soil

- o The end-point sampling conducted onsite after the soil was excavated and removed, indicated that metals were the only contaminants detected above the site SCOs: Part 375-6 unrestricted residential, restricted residential, and residential standards.

| Metal   | Unrestricted | Residential | Restricted Residential | Commercial |
|---------|--------------|-------------|------------------------|------------|
| Iron    | NS           | 2000        | NS                     | NS         |
| Lead    | 63           | 400         | 400                    | 1000       |
| Mercury | 0.18         | 0.81        | 0.81                   | 2.8        |
| Zinc    | 109          | 2200        | 10000                  | 10000      |

- o Iron exceeded the residential SCO. Lead exceeded the unrestricted SCO. Mercury exceeded the unrestricted, restricted residential, and residential SCO. Zinc exceeded the unrestricted SCO.
- o Two volatile organic compounds, and numerous semi-volatile organic compounds were detected but none above an applicable SCO.
- o Any remaining contaminated soil is below the building foundation and vapor barrier at a depth below grade of approximately 13 feet and 17 feet for the elevator pit. There is also contaminated soil remaining under the parking lot are at a depth of approximately 4-feet. The depth at which contamination no longer is expected is unknown.

Table 2 summarizes the results of all soil samples collected that exceeded the Unrestricted Use SCOs and the residential and restricted residential. Figure 4 shows the end-point sampling locations, the metals exceedances, and applicable SCOs at the site after completion of remedial action. The applicable data reports and Date Usability Summary Reports (DUSRs) were submitted in the CCR.

### Groundwater

Groundwater was encountered at approximately 45 feet below ground surface (bgs) in four (4) monitor wells installed in the Phase II investigation and based on

topography, the flow is believed to be west towards the East River. Four (4) groundwater samples were collected and the analytical results indicate that there may be an up-gradient source of contamination that exceeds the DEC TOGS Class GA GW groundwater limits for PCE and TCE. MW-4 was the only well in which the concentration of TCE was below the regulatory limits. Several metals were detected in the groundwater samples. Iron, sodium, silver, and manganese were identified within the samples above regulatory limits for groundwater. Iron, sodium, and manganese are considered naturally occurring metals. A summary table of data for chemical analyses performed on groundwater samples is included in Table 3. Figure 5 shows the groundwater exceedances. The investigation and proposed permanent monitoring wells are shown on Figure 6.

Three new monitoring wells will be installed for long term monitoring of the site as required by the NYSDEC. The new wells will be installed as shown on Figure 6.

#### Soil Vapor

Six (6) soil vapor samples were collected in accordance with the requirements in the most current NYSDOH guidance. Approximately 30 compounds, many of which were chlorinated, were detected in varying levels of concentrations in the six samples. In the parking lot area the concentrations were three orders of magnitude higher than what?. The highest concentrations of PCE, TCE, and TCA are located where the proposed development parking lot will be constructed. There was a problem with sampling equipment for SG-5 and results were presented for discussion purposes only and the data is not considered valid.

Five (5) additional sub-slab, soil vapor samples were collected during the second phase of the RI. TCE was detected above the regulatory limits in four of the five (5) samples with the exception being SS-12. TCE was detected in four (4) of the samples (i.e. SS-10, SS-11, SS-13, and SS-14).

Soil vapor and indoor air samples were collected offsite in neighboring properties and found to have high concentrations of PCE and TCE.

The majority of the soil vapor samples were collected under the former warehouse (sub-slab). Three samples were not collected from under the building. Initially it was thought that there was not a direct correlation between detected contaminants in the soil, soil vapor, and groundwater data. Concentrations of VOCs in soil were detected and concentrations of TCE and PCE in groundwater samples, were above the TOGs. The concentrations of PCE were an order of magnitude above the TOGs criteria, and could have served as the source of VOCs observed in the soil vapor samples. The monitoring wells are shown on Figure 6.

Table 4 and Figure 7 summarize the results of all samples of soil vapor that exceed the SCGs after completion of the remedial action.



### **3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN**

#### **3.1 General**

Since remaining contamination exists at the site, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at the site. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix E) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

#### **3.2 Institutional Controls**

A series of ICs is required by the Decision Document to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to industrial, restricted residential, and commercial uses only. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the

Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are the entire site.

These ICs are:

- The property may be used for: restricted residential and as a commercial activity facility;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYC Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries or entire site, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited;

### 3.3 Engineering Controls

#### 3.3.1 Cover

Exposure to remaining contamination at the site is prevented by a cover system placed over the site. This cover system is comprised of asphalt pavement, concrete-covered sidewalks, and concrete building slabs, and a small landscaped area with 2-feet of clean fill. Figure 8 presents the location of the cover system and engineering controls. The Excavation Work Plan (EWP) provided in Appendix E outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in Appendix F.

Should the building foundation or building slab be removed in the future, a cover system consistent with that described in the September 2017 Decision Document for this site, will be placed in any areas where the upper two feet of exposed surface soil exceed the applicable soil cleanup objectives.

#### 3.3.2 Other ECs: Sub-slab Depressurization Systems; Soil Vapor Extraction Systems

The Sub-slab Depressurization System (SSDS) consists of five (5) zones and has been installed to remove vapor that potentially could infiltrate the sub-grade portion of the building and impact onsite residents. The system addresses the entire footprint of the building and was started on June 2018. The system consists of vapor barrier and extraction points piped to the roof with a vacuum created by exhaust fans on the roof. The vapor barrier consists of a layer of crushed stone, geovent (permeable transmission layer), a geosynthetic liner, PVC sub-grade and cast iron above grade piping through the roof of the building. There are exhaust fans are connected in-line to the piping on the roof and create a vacuum for each zone of the building. Each zone contains sampling points, vacuum

gauges, and an alarm system should the exhaust fan shut down or air flow dramatically decreases. The system is designed to run continuously until such time as the DEC and the New York State Department of Health (DOH) permits reduction in operations or termination of the system.

Procedures for operating and maintaining the SSDS are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP) and in Appendix G – Operations and Maintenance Manual. Figure 8 shows the location of the ECs for the site.

The Soil Vapor Extraction (SVE) system was installed in the driveway/parking lot of the site. The SVE system was installed to contain onsite vapors from migrating offsite into neighboring residential properties. The system consists of four (4) extraction points connected to a PVC pipe gallery that terminates at a skid mounted, package plant that includes the necessary controls, a blower system and multiple, activated carbon canisters. There are sample points on the system to measure the contaminant concentrations in the system and to determine when the canisters need to be rotated out of service. The system is designed to run continuously until such time as removal rates reach asymptotic concentrations and the DEC and DOH allows for the reduced operation or termination of the system.

Procedures for operating and maintaining the SVE system are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP) and in Appendix G – Operations and Maintenance Manual. The piping configuration for the SVE system is also provided in Appendix G. Figure 8 shows the location of the ECs for the site.

### 3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

#### 1.1.1.1 3.3.3.1 - Cover

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity.

#### 3.3.3.2 - Sub-Slab Depressurization (SSD) System

The active SSD system will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH. In the event that monitoring data indicates that the SSD system may no longer be required, a proposal to discontinue the SSD system will be submitted by the remedial party to the NYSDEC and NYSDOH.

#### 3.3.3.3 - Soil Vapor Extraction System (SVE) System

The SVE system will not be discontinued unless prior written approval is granted by the NYSDEC and DOH. In the event that monitoring data indicates that the SVE system may no longer be required, a proposal to discontinue the system will be submitted by the remedial party. Conditions that may warrant discontinuing the SVE system include contaminant concentrations in groundwater and/or soil that: (1) reach levels that are consistently below ambient water quality standards or the site SCGs, as appropriate; (2) have become asymptotic to a low level over an extended period of time, as accepted by the NYSDEC; or (3) the NYSDEC has determined that the SVE system has reached the limit of its effectiveness. This assessment will be based in part on post-remediation contaminant levels in groundwater collected from monitoring wells located throughout the site. Systems will remain in place and operational until permission to discontinue their use is granted in writing by the NYSDEC.

## **4.0 MONITORING AND SAMPLING PLAN**

### **4.1 General**

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix H.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, soil vapor, soils);
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and Part 375 SCOs for soil; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Sampling locations, protocol and frequency;
- Information on all designed monitoring systems;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;
- Monitoring well decommissioning procedures; and

- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

## **4.2 Site – wide Inspection**

Site-wide inspections will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report. The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date; and

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

### **4.3 Treatment System Monitoring and Sampling**

#### **4.3.1 Remedial System Monitoring**

Monitoring of the SSDS and SVE systems will be performed on a routine basis, as identified in Table 5 Remedial System Monitoring Requirements and Schedule (see below). Modification to the frequency or sampling requirements will require approval from the NYSDEC. A visual inspection of the complete system will be conducted during each monitoring event. Unscheduled inspections and/or sampling may take place when a suspected failure of the SSDS and/or SVE system has been reported or an emergency occurs that is deemed likely to affect the operation of the system. SSDS and SVE system components to be monitored include, but are not limited to, the components included in Table 5 below.



**Table 5 – Remedial System Monitoring Requirements and Schedule**

| <b>Remedial System Component</b> | <b>Monitoring Parameter</b>                                                          | <b>Operating Range</b>                                                   | <b>Monitoring Schedule</b> |
|----------------------------------|--------------------------------------------------------------------------------------|--------------------------------------------------------------------------|----------------------------|
| Sub-slab Depressurization        | Vacuum and Flow Rate                                                                 | 0.01 in of water                                                         | Quarterly                  |
| Soil Vapor Extraction            | Influent Vacuum<br>Flowrate<br>Exhaust PID (pre-carbon)<br>Exhaust PID (post-carbon) | -12 to -50+ (in WC)<br><br>110 – 153 cfm<br>0 – 2,530 ppm<br>95% removal | Monthly                    |
| Cover System                     | Damage to basement slab, sidewalks, and parking lot surfaces                         | None                                                                     | Annually                   |
| Monitoring Wells                 | Sample for groundwater SCO                                                           | Groundwater SCOs                                                         | Annually                   |

A complete list of components to be inspected is provided in the Inspection Checklist, provided in Appendix I - Site Management Forms. If any equipment readings are not within their specified operation range, any equipment is observed to be malfunctioning or the system is not performing within specifications; maintenance and repair, as per the Operation and Maintenance Plan, is required immediately.

#### 4.3.2 Remedial System Sampling

Effluent sampling will be conducted on the SSDS. Effluent sampling for the SSDS will be completed to determine if additional controls such as carbon treatment are required. If necessary, then the effluent from the SSDS will be evaluated periodically.

Influent and effluent sampling will be done for the SVE system. Air samples shall be collected from the SVE systems on a routine basis. Sampling locations, required analytical parameters and schedule are provided in Table 6 – Remedial System Sampling

Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

**Table 6 – Remedial System Sampling Requirements and Schedule**

| Sampling Location           | Schedule                        |                                   |
|-----------------------------|---------------------------------|-----------------------------------|
|                             | VOC<br>(EPA<br>Method<br>TO-15) |                                   |
| SSDS zones 1-5 effluent     | X                               | Confirmation<br>sampling (1-time) |
|                             |                                 |                                   |
| SVE – influent and effluent | X                               | Monthly                           |
|                             |                                 |                                   |

Detailed analytical procedures and protocols are provided in Appendix H – Quality Assurance Project Plan. Detailed sample collection procedures are explained the Field Sampling Plan in Appendix J. The sampling procedures will comply with the most current version of the DOH Vapor Intrusion Guidance.

#### **4.4 Post-Remediation Media Monitoring and Sampling**

Samples shall be collected from the proposed monitoring wells and indoor air on a routine basis. Sampling locations, required analytical parameters and schedule are provided in Table 7 – Post Remediation Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

**Table 7 – Post Remediation Sampling Requirements and Schedule**

| <b>Sampling Location</b>     | <b>Schedule</b>   |                                      |                                |                 |                        |                                      |
|------------------------------|-------------------|--------------------------------------|--------------------------------|-----------------|------------------------|--------------------------------------|
|                              | VOCs Method 8260) | SVOCs & Pesticides Method 8270& 8081 | TAL Metals Method 6010C/ 7471B | PFAs Method 537 | VOC (EPA Method TO-15) |                                      |
| Monitoring Well #1, 2, and 3 | X                 | X                                    | X                              | X               |                        | Annually                             |
| Indoor air                   |                   |                                      |                                |                 | X                      | Annually inside basement of building |

Detailed analytical procedures and protocols are provided in Appendix H – Quality Assurance Project Plan. Samples will be collected in accordance with the requirements in DER-10.

#### 4.4.1 Groundwater Sampling

Groundwater monitoring will be performed annually to assess contaminant concentrations. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells will be installed to monitor upgradient and downgradient groundwater conditions at the site.

The well identification number, as well as the purpose, location, depths, diameter, and screened intervals of the wells will be provided upon completion. As part of the groundwater monitoring, three on-site wells will be sampled to evaluate the quality of the groundwater.

Monitoring well construction logs will be provided upon completion

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

#### 4.4.2 Soil Vapor Sampling

Soil vapor sampling will be performed indirectly through the SVE system influent to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

#### 4.4.3 Soil Vapor Intrusion Sampling

Soil vapor intrusion sampling will be performed annually inside the basement of the building to assess the performance of the remedy. Offsite locations will be monitored

on an annual basis by the DEC. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of on-site vapor intrusion sample locations has been designed based on providing coverage throughout the basement of the building and the samples will be analyzed for TO+15. The air samples will be analyzed by an ELAP approved laboratory.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the soil vapor intrusion sampling program are specified in Section 7.0 – Reporting Requirements.

#### 4.4.4 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in Appendix I - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific Field Sampling Plan provided as Appendix J of this document.

## **5.0 OPERATION AND MAINTENANCE PLAN**

### **5.1 General**

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the site to operate and maintain the SSDS and SVE systems;
- Will be updated periodically to reflect changes in site conditions or the manner in which the SSDS and SVE systems are operated and maintained.

Further detail regarding the Operation and Maintenance of the SSDS and SVE is provided in Appendix G - Operation and Maintenance Manual. A copy of this Operation and Maintenance Manual, along with the complete SMP, is to be maintained at the site. This Operation and Maintenance Plan is not to be used as a stand-alone document, but as a component document of this SMP.

### **5.2 Operations and Maintenance of SSDS and SVE**

The Remedial system performance criteria is included in the O&M manuals for each system and provided in Appendix G.

### **5.3 Operation and Maintenance of SSDS**

The following sections provide a description of the operations and maintenance of the SSDS. Cut-sheets and as-built drawings for the SSDS are provided in Appendix G - Operations and Maintenance Manual. All discharge permits or permit equivalencies are provided in Appendix L.

### 5.3.1 System Start-Up and Testing

The system start-up, testing, and operations followed the prescribed steps in the O&M manual for the SSDS and SVE mechanical components. The Pre start-up inspections included all visible components of the system. For both the SSDS and SVE systems, a large part of the system is underground. Pressure gauges should fit snugly into the piping. The alarms shall be tested to ensure that if the power is cut, they will activate.

For the SSDS, the piping shall be inspected to ensure there are no leaks, loose joints, etc. A micro-manometer will be used to test for a vacuum in each zone.

For the SVE system, an inspection of the piping similar to that for the SSDS will take place. In addition, a complete implementation of the start-up steps will be completed in accordance with the O&M manual. The results of the pre start-up tests will be recorded and maintained onsite.

Baseline sampling of both systems will take place as soon as possible after start-up to determine initial sub-surface vapor conditions. Air samples will be collected from the basement and the SSDS piping before the exhaust fans for TO+15 analysis. Air samples from the SVE system will be collected at an influent and effluent point as well as between carbon canisters to obtain initial subsurface conditions and removal efficiency.

The system testing described above will be conducted if, in the course of the systems' lifetimes, they go down or significant changes are made to the systems and they must be restarted.

### 5.3.2 Routine System Operation and Maintenance

Routine SSDS and SVE Operations and Maintenance will follow the manufacturer's recommendations for the various components of each system. Inspections will be completed per the Remedial Systems Inspection Schedule on Table 5. If either system is not operating properly, the troubleshooting guidance will be consulted first and if that does not provide the necessary answers to address the situation, the system's technical advisors will be contacted. Both systems are designed to operate continuously until such time as

they need to be replaced or the DEC and DOH permit a reduction in operation or termination of either system.

There are few adjustments that can be made to the SSDS. Repairs will be made as required during the operating life of the exhaust fans.

The SVE system will be adjusted based on the removal efficiency and the offsite vapor intrusion data from the DEC. Adjustments may include shutting down a portion of the extraction points so that no air is being evacuated, reducing the rate of the mechanical blowers, sizing of the carbon canisters, etc. Any of these adjustments will be made only with the approval of the DEC and/or DOH. Other adjustments may be made based solely on the mechanical operation of the equipment when necessary.

A copy of an Operations and Maintenance Manual specific to the remedial systems is provided in Appendix G, which will provide further detail on the above.

#### 5.3.3 Non-Routine Operation and Maintenance

Non-routine O&M will be done as an as-needed basis given the current situation. Those situations could include the activation of warning devices or alarms, damage done to system components deliberately or from storms, reduced effectiveness not associated with the reduction in concentrations of contaminants, and/or if it is time for parts replacement sooner than anticipated. The maintenance will be conducted as required and the system will be thoroughly inspected to determine why the non-routine measures were needed. The reasons for the non-routine maintenance may be indicative of some larger operational issues or changes in site conditions which need to be understood.

A summary and schedule of routine maintenance for both systems are provided in Appendix G.

#### 5.3.4 System Monitoring Devices and Alarms

The SSDS system has alarm devices to indicate that the system is not operating properly. In the event that warning device is activated, applicable maintenance and repairs



will be conducted, as specified in the Operation and Maintenance Plan, and the SSDS system will be restarted. Operational problems will be noted in the Periodic Review Report (PRR) to be prepared for that reporting period.

The SVE system has numerous warning devices for the monitoring of various components of the system. The system has monitoring devices and alarm notifications for SVE vacuum blower failure, pressures and temperatures out of operating range, and the accumulation of water in the system, etc.

The SVE system has warning devices to indicate that the system is not operating properly. In the event that warning device is activated, applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan, and the SVE system will be restarted. Operational problems will be noted in the Periodic Review Report to be prepared for that reporting period. The warnings will be addressed with the necessary maintenance, reset and noted in the inspection log, PRR.

## **6.0 PERIODIC ASSESSMENTS/EVALUATIONS**

### **6.1 Climate Change Vulnerability Assessment**

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

**High Wind:** The site is susceptible to damage from high winds as the SSDS exhaust fans are located on the roof of the building. Even if properly anchored, given strong enough winds, they may be knocked off their piping and rendered inoperable.

**Electricity:** Sustained, long-term, loss of electricity will impact the ability of the remedial systems to operate and potentially cause exposure to onsite contaminants. This more of a concern with the SVE system not being able to control the vapor intrusion conditions for the neighboring properties. It may be necessary to have a back-up generator on standby for instances when there is long term power loss.

**Spill/Contaminant Release:** There are no known remaining items onsite that could result in a new release or spill onsite.

## 6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the PRR.

- Waste Generation will be limited to the regeneration of spent carbon from the SVE system. The carbon units will be used to the maximum extent possible before being regenerated on or offsite. If possible, they will be regenerated onsite to reduce travel requirements.
- Energy usage will be reduced to the extent possible by minimizing the use of the operation of the SVE system and potentially the SSDS as quickly as possible. If possible, a reduction in the fan and/or motor size will be evaluated to potentially reduce power usage for the systems.
- Emissions will be limited by the proper operation of the SSDS and SVE systems. SSDS emissions will be dispersed at roof top level and little to no impact on health or the environment. SVE emissions will be limited by the removal efficiency of the system. In addition, to the extent possible, the SVE operations will be reduced or terminated as quickly as possible.

Methods proposed to reduce energy consumption, resource usage, waste generation, water usage, etc., will be included in the PRR.

### 6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities. An outline of RSO report are provided in Appendix K.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

### 6.2.2 Remedial Systems

Remedial systems will be operated properly considering the current site conditions to conserve materials and resources to the greatest extent possible. Consideration will be given to operating rates and use of reagents and consumables. Spent materials will be recycled onsite if possible or sent for recycling, as appropriate.

Remedial system types and associated parameters to be evaluated include, but are not limited to:

- Soil vapor extraction operations rates based on the removal of contaminants;
- Activated carbon systems (spent carbon replacement and disposal or regeneration);
- SSDS operations

### 6.2.3 Building Operations

Buildings and sheds will be operated and maintained to provide for the most efficient operation of the remedy, while minimizing energy, waste generation and water consumption.

Components to be evaluated included, but are not limited to:

- Heating/cooling systems and temperature set-points;
- Building skin, insulation and building use and occupancy;
- Ventilation;
- Lighting and plug loads; and
- Grounds and property management.

### 6.2.4 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site and use of consumables in relation to visiting the Site in order to conduct system checks and or collect samples and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

To the extent possible, onsite staff (building superintendent, janitorial staff, etc.) shall be trained to inspect, observe, and report on system operations so as to reduce the number of visits by offsite personnel. It is assumed that they will use public transportation to get to the site and/or live on the premises. Once the system has been in operation for approximately 6-12 months, a review will be done to optimize inspections by offsite personnel.

Other than testing and routine maintenance, the SSDS will only need to be addressed by offsite personnel should the system shut down.

#### 6.2.5 Metrics and Reporting

As discussed in Section 7.0 and as shown in Appendix I – Site Management Forms, information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits; a set of metrics has been developed.

### **6.3 Remedial System Optimization**

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;

- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study focuses on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO. The table of contents for the RSO is provided in Appendix K.

## 7.0. REPORTING REQUIREMENTS

### 7.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 8 and summarized in the Periodic Review Report.

**Table 8: Schedule of Interim Monitoring/Inspection Reports**

| <b>Task/Report</b>     | <b>Reporting Frequency*</b>                            |
|------------------------|--------------------------------------------------------|
| Inspection Report      | Monthly                                                |
| Periodic Review Report | Annually, or as otherwise determined by the Department |

\* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc.);

- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and



- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link <http://www.dec.ny.gov/chemical/62440.html>.

## **7.2 Periodic Review Report**

A PRR will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: <http://www.dec.ny.gov/chemical/62440.html>.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
  - The overall performance and effectiveness of the remedy.
- A performance summary for all treatment systems at the site during the calendar year, including information such as:
  - The number of days the system operated for the reporting period;
  - The average, high, and low flows per day;
  - The contaminant mass removed;
  - A description of breakdowns and/or repairs along with an explanation for any significant downtime;
  - A description of the resolution of performance problems;
  - Alarm conditions;
  - Trends in equipment failure;

- A summary of the performance, effluent and/or effectiveness monitoring; and
- Comments, conclusions, and recommendations based on data evaluation.

### 7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional or Professional Engineer licensed to practice in New York State will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

*“For each institutional or engineering control identified for the site, I certify that all of the following statements are true:*

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices;*

- *No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid;*
- *The assumptions made in the qualitative exposure assessment remain valid. This will be included in the IC/EC certification every 5-years and*
- *The information presented in this report is accurate and complete.*

*I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner’s/Remedial Party’s Designated Site Representative]”*

At the end of each certifying period, as determined by the NYSDEC, the following certification will be provided to the Department:

*“For each institutional control identified for the site, I certify that all of the following statements are true:*

- *The institutional control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*
- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement.*

- *No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid.*
- *The assumptions made in the qualitative exposure assessment remain valid. This will be included in the IC/EC certification every 5-years*
- *The information presented in this report is accurate and complete.*

*I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner or Owner’s Designated Site Representative]”*

The signed certification will be included in the Periodic Review Report.

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

### **7.3 Corrective Measures Work Plan**

If any component of the remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a Corrective Measures Work Plan will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the Corrective Measures Work Plan until it has been approved by the NYSDEC.

### **7.4 Remedial Site Optimization Report**

In the event that an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the Department for approval. A general

outline for the RSO report is provided in Appendix K. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

## **8.0 REFERENCES**

Hillmann Consulting LLC, 2013 Phase I Environmental Site Assessment

Equity Environmental Engineering LLC, 2016 Phase II Report

Equity Environmental Engineering LLC, 2016 IRMWP

Equity Environmental Engineering LLC, 2017 Construction Closure Report

NYSDEC 2017 Decision Document

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

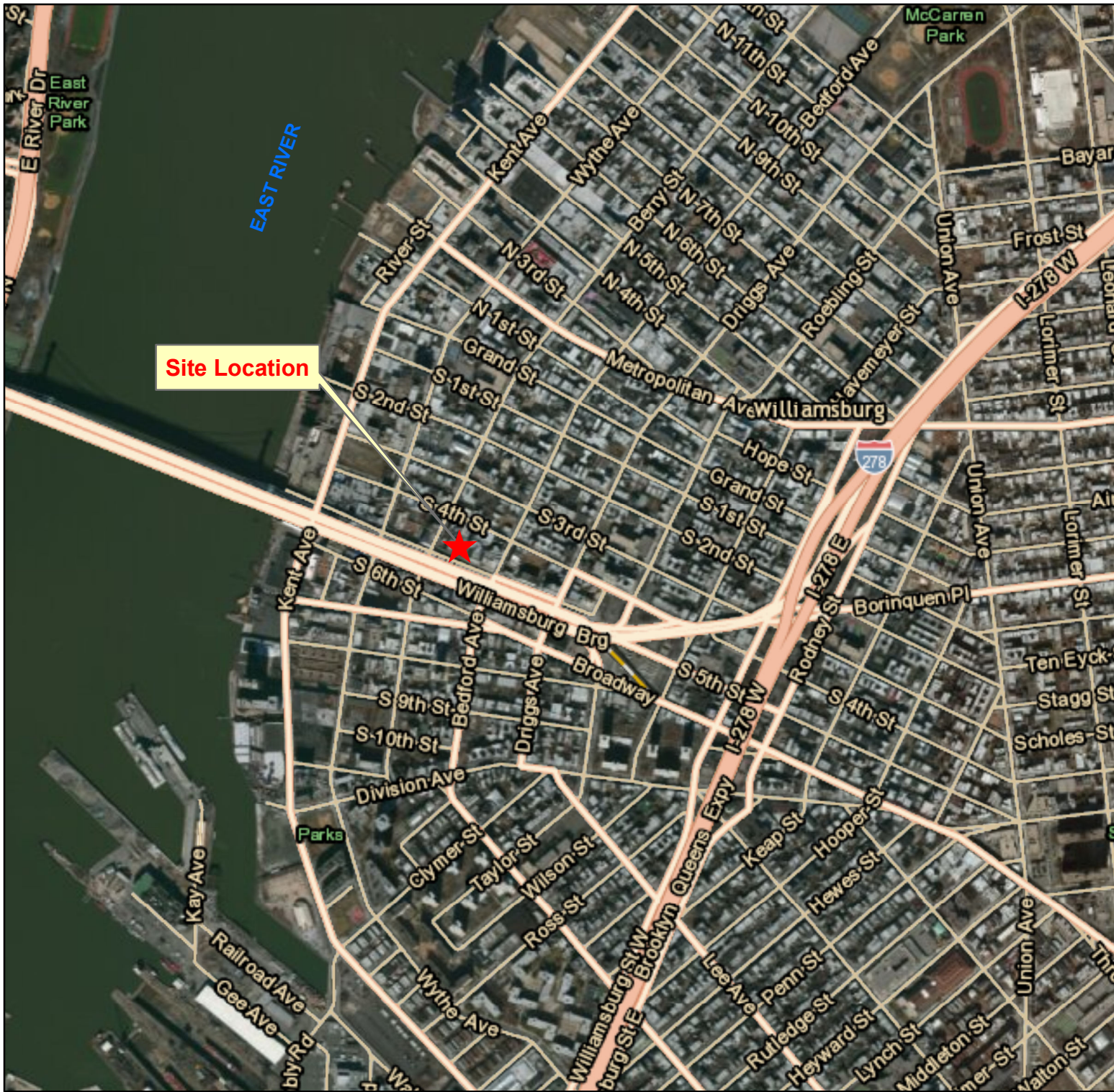
NYSDEC DER-10 – “Technical Guidance for Site Investigation and Remediation”.

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

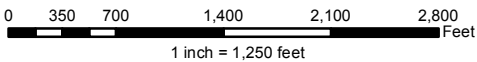
NYSDOH Guidance for Evaluating of Soil Vapor Intrusion in the State of New York. October 2006

## **FIGURES**





Notes: Aerial basemap provided by Esri, HERE, DeLorme, TomTom, MapmyIndia, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo; Copyright:© OpenStreetMap contributors, and the GIS user community



## FIGURE 1 SITE LOCATION MAP

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lots 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**

227 Route 206, Suite 6, Flanders, NJ 07836, (973) 527-7451

DRAWN BY/ DATE

CHK/DATE

DRAWING NUMBER

NG / 04-14-15

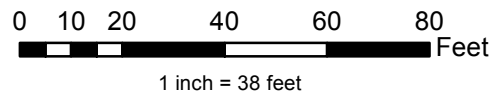
2014074-01





### Legend

- Soil Boring (SB)
- Soil Vapor Sample Point (SG/SS)
- Groundwater Monitoring Well
- Property Boundary



### FIGURE 2 SITE MAP

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**  
500 International Drive, Suite 150, Mount Olive, NJ 07828  
Office: (973) 527-7451 / Fax: (973) 858-0280

DRAWN BY / DATE

REV / DATE

DRAWING NUMBER

FU / 02272017

2015059-05

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community



## Legend

95 South 5th Street



## FIGURE 3 TAX MAP

337 Berry St & 99-105 South 5th Street  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**

500 International Drive, Suite 150, Mount Olive, NJ 07828  
Office: (973) 527-7451 / Fax: (973) 858-0280

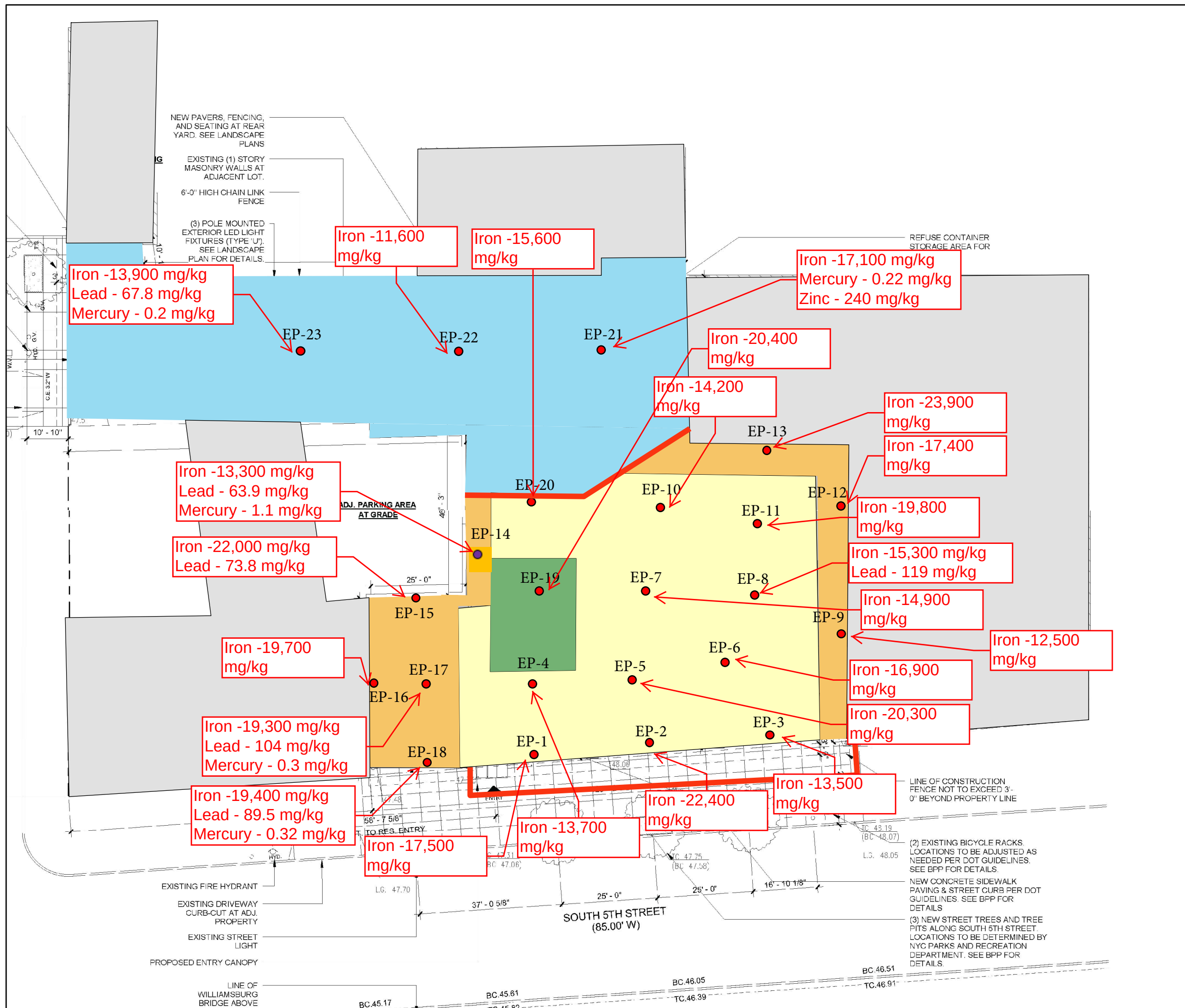
DRAWN BY / DATE

REV / DATE

DRAWING NUMBER

GB/7.30.18

2015059-01



## Legend

- Lined Sheetting
- End-Point Soil Sample Location
- Exceedance
- Adjoining Buildings
- Elevator Pit Excavation Area (17')
- Outer Excavation Area
- Inner Excavation Area (13')
- Parking Lot

FIGURE 4  
REMAINING SOIL SAMPLE  
EXCEEDANCES

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**  
500 International Drive, Suite 150, Mount Olive, NJ 07828  
Office: (973) 527-7451 / Fax: (973) 858-0280

EDITED BY / DATE

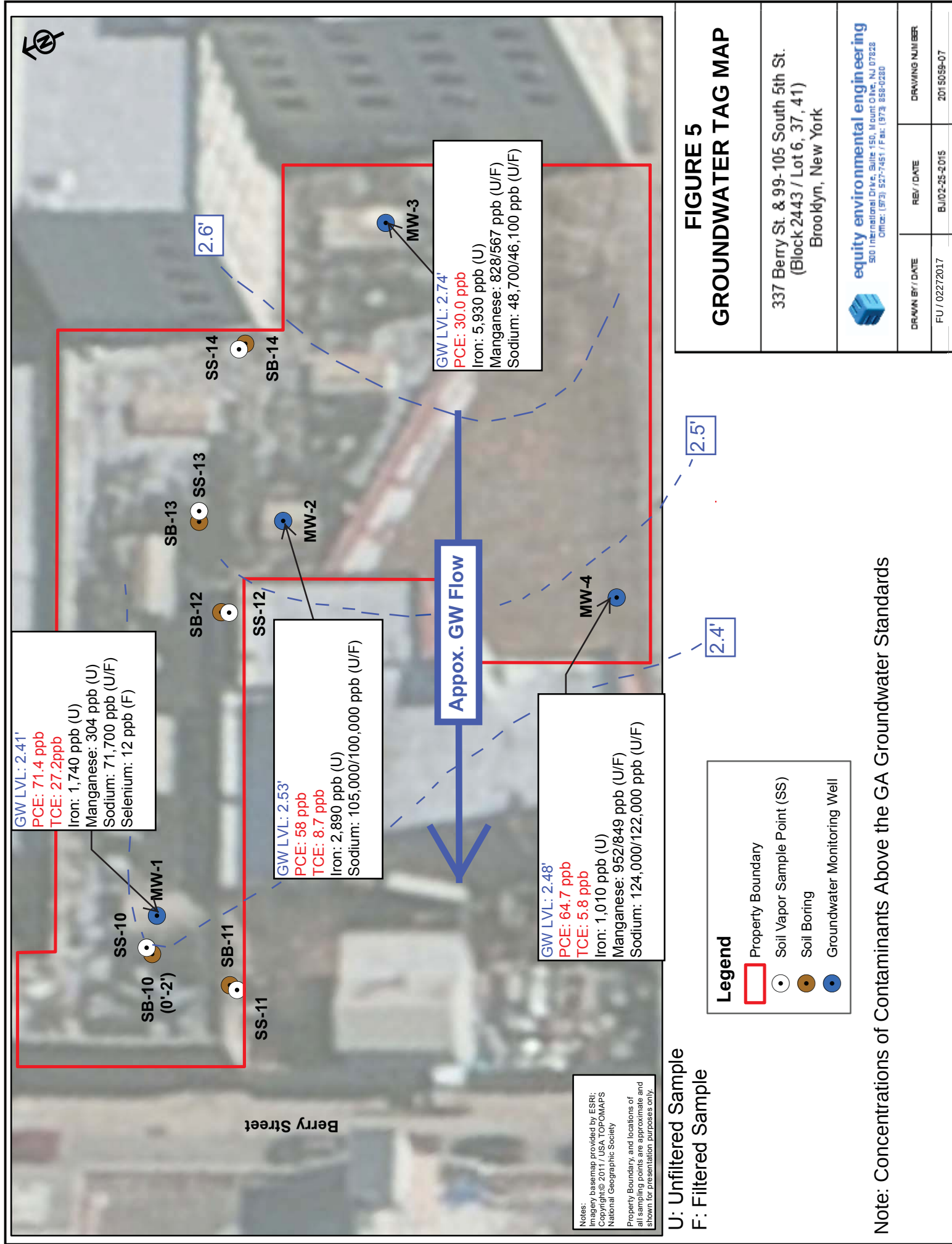
REV / DATE

DRAWING NUMBER

JRV / 01112017

2015059-09







### Legend

 Property Boundary

 Monitoring Wells

**FIGURE 6**  
**Monitoring Well Locations**

337 Berry St. & 99-105 South 5th St.  
 (Block 2443 / Lot 6, 37, 41)  
 Brooklyn, New York



**equity environmental engineering**

500 International Drive, Suite 150, Mount Olive, NJ 07828  
 Office: (973) 527-7451 / Fax: (973) 858-0280

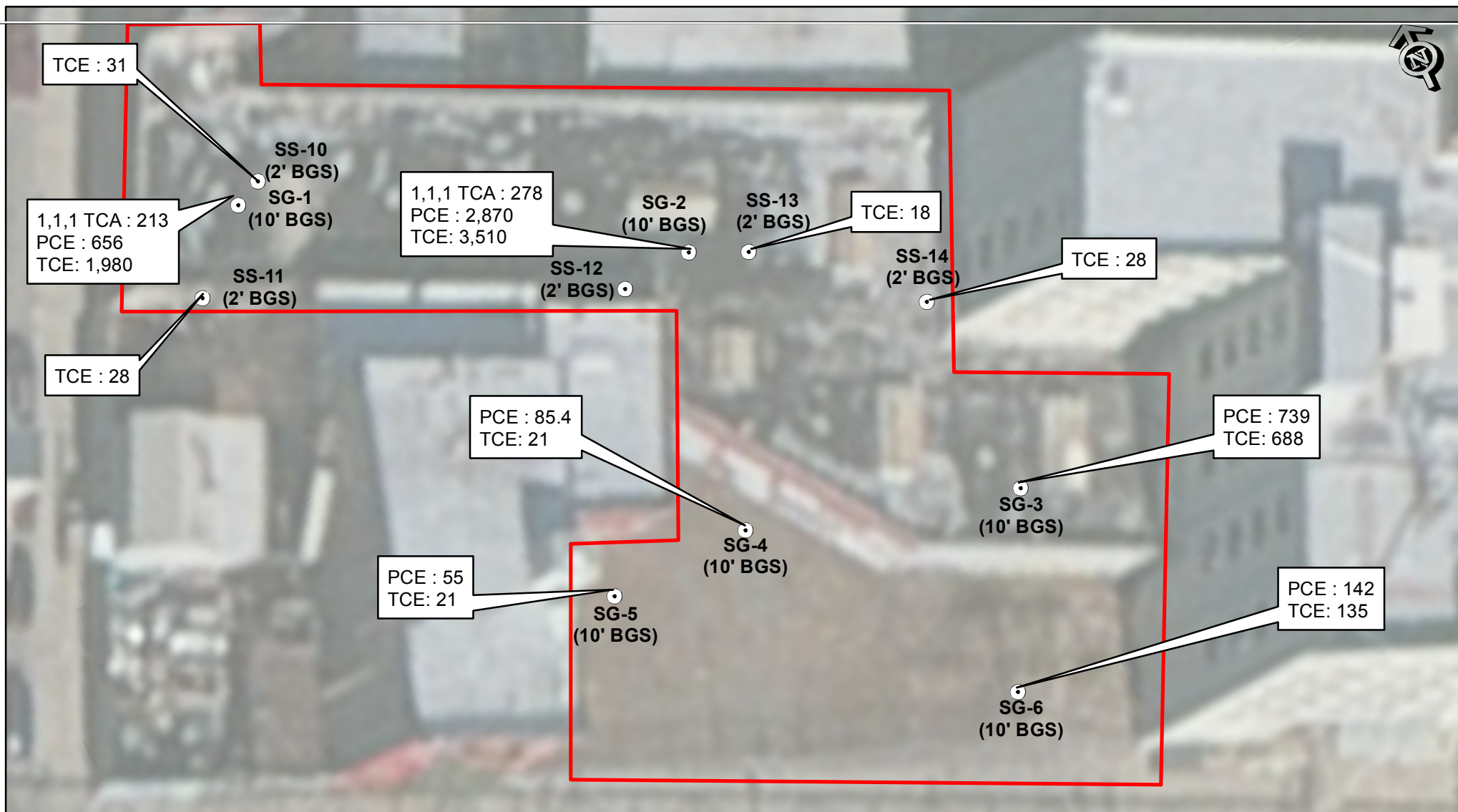
DRAWN BY / DATE

REV / DATE

DRAWING NUMBER

GB/10.2.18

2015059-04



0 10 20 40 60 80 Feet  
1 inch = 35 feet

SG 1-6 collected at 10-feet below ground surface  
SG 10-14 collected at 2-feet below ground surface

Notes:  
Imagery basemap provided by ESRI; Copyright:© 2011 / USA TOPOMAPS;  
National Geographic Society

Property Boundary, and locations of all sampling points are approximate  
and shown for presentation purposes only.

### Legend

- Property Boundary
- Soil Vapor Sample Results (ug/m3)
- 1,1,1 TCA Trichloroethane (100.0 ug/m3)
- TCE Trichloroethylene (2.0 ug/m3)
- PCE Tetrachloroethylene (30.0 ug/m3)

Note: Criteria Determined by MOER

## FIGURE 7 SOIL VAPOR EXCEEDANCES

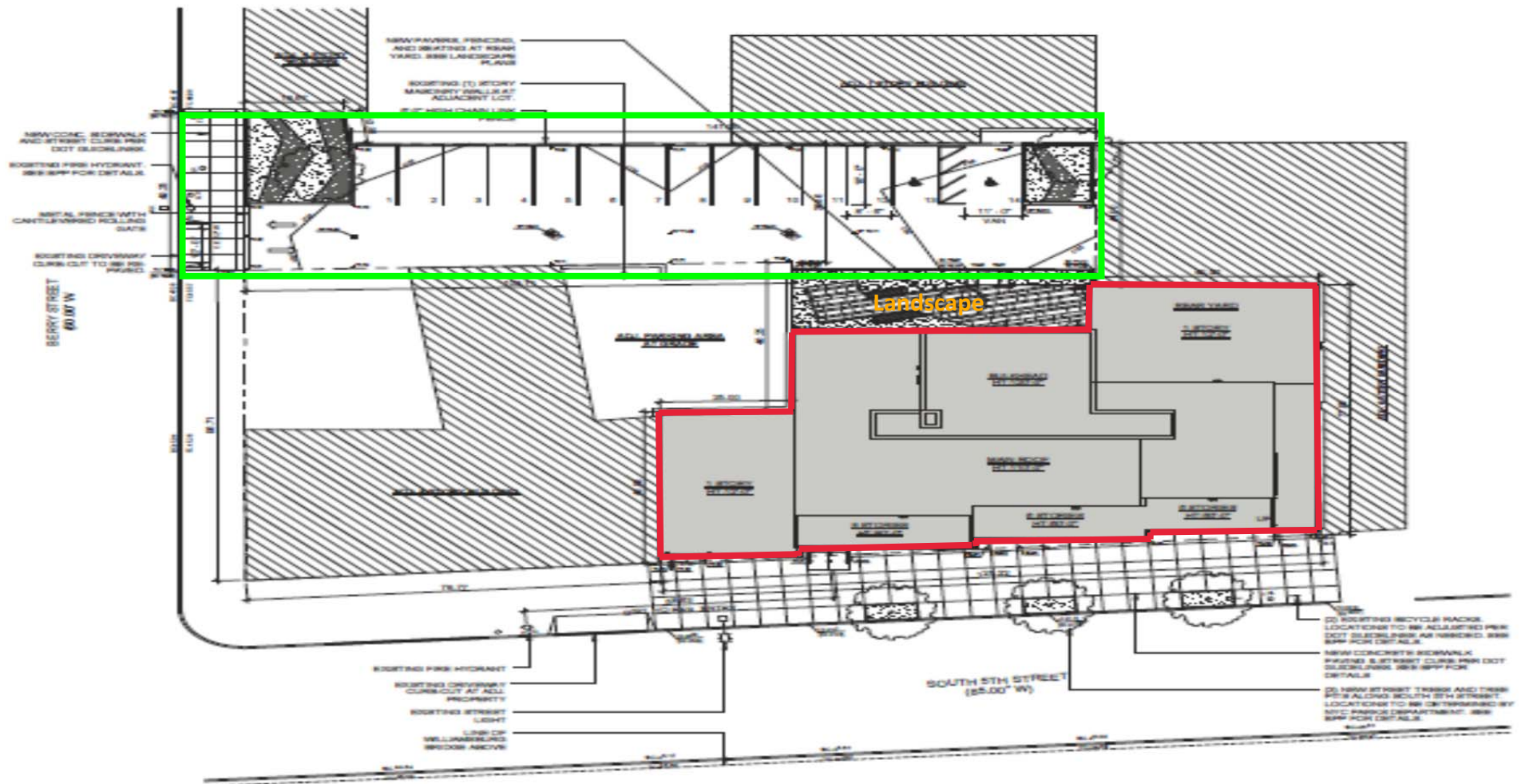
337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**  
500 International Drive, Suite 150, Mount Olive, NJ 07828  
Office: (973) 527-7451 / Fax: (973) 858-0280

| DRAWN BY / DATE | REV / DATE | DRAWING NUMBER |
|-----------------|------------|----------------|
| FU / 02272017   |            | 2015059-07     |





Note: Drawing is not drawn to scale. Original drawing copied from "Figure 5: Proposed Site Plan" created by Dattner Architects, D.P.C.

□ SSDS  
□ SVE

FIGURE 8  
Engineering Controls

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York

  
 equity environmental engineering  
 500 International Drive, Suite 150, Mount Olive, NJ 07828  
 Office: (973) 527-7451 / Fax: (973) 858-0280

Drawn By: NG/11-06-15 | Drawing Number: 2015059-03



## **TABLES**

Table 2  
Remaining Soil Sample Exceedances

[illegible]

Table 2  
Remaining Soil Sample Exceedances

[illegible]

Table 3  
Remaining Groundwater Exceedances

| Client Sample ID:             |      | NY TOGS Class<br><br>GA GW Standards<br>(NYSDEC 6/2004) <sup>1</sup> | MW-4         | MW-4                    | MW-3         | MW-3                    | FB-1                 | FB-1                    | MW-201       | MW-201                  | MW-2         | MW-2                    | MW-1         | MW-1                    | TRIP BLANK          |
|-------------------------------|------|----------------------------------------------------------------------|--------------|-------------------------|--------------|-------------------------|----------------------|-------------------------|--------------|-------------------------|--------------|-------------------------|--------------|-------------------------|---------------------|
| Lab Sample ID:                |      |                                                                      | JC12052-1    | JC12052-1F              | JC12052-2    | JC12052-2F              | JC12052-3            | JC12052-3F              | JC12052-4    | JC12052-4F              | JC12052-5    | JC12052-5F              | JC12052-6    | JC12052-6F              | JC12052-7           |
| Date Sampled:                 |      |                                                                      | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016             | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016            |
| Matrix:                       |      |                                                                      | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Field Blank<br>Water | Field Blank<br>Filtered | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Trip Blank<br>Water |
| GC/MS Volatiles (SW846 8260C) |      |                                                                      |              |                         |              |                         |                      |                         |              |                         |              |                         |              |                         |                     |
| Acetone                       | ug/l | -                                                                    | ND (3.3)     | -                       | ND (3.3)     | -                       | ND (3.3)             | -                       | ND (3.3)     | -                       | ND (3.3)     | -                       | ND (0.93)    | -                       | -                   |
| Benzene                       | ug/l | 1                                                                    | ND (0.24)    | -                       | ND (0.24)    | -                       | ND (0.24)            | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | ND (1.4)     | -                       | -                   |
| Bromochloromethane            | ug/l | 5                                                                    | ND (0.37)    | -                       | ND (0.37)    | -                       | ND (0.37)            | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | ND (1.3)     | -                       | -                   |
| Bromodichloromethane          | ug/l | -                                                                    | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)            | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (1.3)     | -                       | -                   |
| Bromoform                     | ug/l | -                                                                    | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)            | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (1.1)     | -                       | -                   |
| Bromomethane                  | ug/l | 5                                                                    | ND (0.42)    | -                       | ND (0.42)    | -                       | ND (0.42)            | -                       | ND (0.42)    | -                       | ND (0.42)    | -                       | ND (0.87)    | -                       | -                   |
| 2-Butanone (MEK)              | ug/l | -                                                                    | ND (5.6)     | -                       | ND (5.6)     | -                       | ND (5.6)             | -                       | ND (5.6)     | -                       | ND (5.6)     | -                       | ND (0.82)    | -                       | -                   |
| Carbon disulfide              | ug/l | 60                                                                   | ND (0.25)    | -                       | ND (0.25)    | -                       | ND (0.25)            | -                       | ND (0.25)    | -                       | ND (0.25)    | -                       | ND (0.67)    | -                       | -                   |
| Carbon tetrachloride          | ug/l | 5                                                                    | ND (0.22)    | -                       | ND (0.22)    | -                       | ND (0.22)            | -                       | ND (0.22)    | -                       | ND (0.22)    | -                       | ND (1.4)     | -                       | -                   |
| Chlorobenzene                 | ug/l | 5                                                                    | ND (0.19)    | -                       | ND (0.19)    | -                       | ND (0.19)            | -                       | ND (0.19)    | -                       | ND (0.19)    | -                       | ND (1.1)     | -                       | -                   |
| Chloroethane                  | ug/l | 5                                                                    | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (0.34)            | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (1.4)     | -                       | -                   |
| Chloroform                    | ug/l | 7                                                                    | 3            | -                       | 4.2          | -                       | ND (0.19)            | -                       | 2.1          | -                       | 2.3          | -                       | ND (0.31)    | -                       | -                   |
| Chloromethane                 | ug/l | 5                                                                    | ND (0.41)    | -                       | ND (0.41)    | -                       | ND (0.41)            | -                       | ND (0.41)    | -                       | ND (0.41)    | -                       | ND (1.4)     | -                       | -                   |
| Cyclohexane                   | ug/l | -                                                                    | ND (0.28)    | -                       | ND (0.28)    | -                       | ND (0.28)            | -                       | ND (0.28)    | -                       | ND (0.28)    | -                       | ND (1.5)     | -                       | -                   |
| 1,2-Dibromo-3-chloropropane   | ug/l | 0.04                                                                 | ND (0.99)    | -                       | ND (0.99)    | -                       | ND (0.99)            | -                       | ND (0.99)    | -                       | ND (0.99)    | -                       | ND (1.4)     | -                       | -                   |
| Dibromochloromethane          | ug/l | -                                                                    | ND (0.15)    | -                       | ND (0.15)    | -                       | ND (0.15)            | -                       | ND (0.15)    | -                       | ND (0.15)    | -                       | ND (0.29)    | -                       | -                   |
| 1,2-Dibromoethane             | ug/l | 0.0006                                                               | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)            | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.24)    | -                       | -                   |
| 1,2-Dichlorobenzene           | ug/l | 3                                                                    | ND (0.19)    | -                       | ND (0.19)    | -                       | ND (0.19)            | -                       | ND (0.19)    | -                       | ND (0.19)    | -                       | ND (0.28)    | -                       | -                   |
| 1,3-Dichlorobenzene           | ug/l | 3                                                                    | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)            | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.25)    | -                       | -                   |
| 1,4-Dichlorobenzene           | ug/l | 3                                                                    | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.27)            | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.42)    | -                       | -                   |
| Dichlorodifluoromethane       | ug/l | 5                                                                    | ND (0.90)    | -                       | ND (0.90)    | -                       | ND (0.90)            | -                       | ND (0.90)    | -                       | ND (0.90)    | -                       | ND (0.34)    | -                       | -                   |
| 1,1-Dichloroethane            | ug/l | 5                                                                    | ND (0.17)    | -                       | ND (0.17)    | -                       | ND (0.17)            | -                       | ND (0.17)    | -                       | ND (0.17)    | -                       | ND (0.32)    | -                       | -                   |
| 1,2-Dichloroethane            | ug/l | 0.6                                                                  | ND (0.18)    | -                       | ND (0.18)    | -                       | ND (0.18)            | -                       | ND (0.18)    | -                       | ND (0.18)    | -                       | ND (0.33)    | -                       | -                   |
| 1,1-Dichloroethene            | ug/l | 5                                                                    | ND (0.51)    | -                       | 1.1          | -                       | ND (0.51)            | -                       | 0.57 J       | -                       | 0.53 J       | -                       | ND (0.32)    | -                       | -                   |
| cis-1,2-Dichloroethene        | ug/l | 5                                                                    | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.27)            | -                       | 0.51 J       | -                       | 0.61 J       | -                       | ND (0.41)    | -                       | -                   |
| trans-1,2-Dichloroethene      | ug/l | 5                                                                    | ND (0.65)    | -                       | ND (0.65)    | -                       | ND (0.65)            | -                       | ND (0.65)    | -                       | ND (0.65)    | -                       | ND (0.37)    | -                       | -                   |
| 1,2-Dichloropropane           | ug/l | 1                                                                    | ND (0.39)    | -                       |              |                         |                      |                         |              |                         |              |                         |              |                         |                     |

Table 3  
Remaining Groundwater Exceedances

| Client Sample ID:                  |      | NY TOGS Class                | MW-4         | MW-4                    | MW-3         | MW-3                    | FB-1                 | FB-1                    | MW-201       | MW-201                  | MW-2         | MW-2                    | MW-1         | MW-1                    | TRIP BLANK          |
|------------------------------------|------|------------------------------|--------------|-------------------------|--------------|-------------------------|----------------------|-------------------------|--------------|-------------------------|--------------|-------------------------|--------------|-------------------------|---------------------|
| Lab Sample ID:                     |      | GA GW Standards              | JC12052-1    | JC12052-1F              | JC12052-2    | JC12052-2F              | JC12052-3            | JC12052-3F              | JC12052-4    | JC12052-4F              | JC12052-5    | JC12052-5F              | JC12052-6    | JC12052-6F              | JC12052-7           |
| Date Sampled:                      |      | (NYSDEC 6/2004) <sup>1</sup> | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016             | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016            |
| Matrix:                            |      |                              | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Field Blank<br>Water | Field Blank<br>Filtered | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Trip Blank<br>Water |
| GC/MS Semi-volatiles (SW846 8270D) |      |                              |              |                         |              |                         |                      |                         |              |                         |              | -                       | ND (0.36)    | -                       | -                   |
| 2-Chlorophenol                     | ug/l | -                            | ND (0.94)    | -                       | ND (0.96)    | -                       | ND (0.93)            | -                       | ND (0.93)    | -                       | ND (0.93)    | -                       | ND (0.38)    | -                       | -                   |
| 4-Chloro-3-methyl phenol           | ug/l | -                            | ND (1.4)     | -                       | ND (1.4)     | -                       | ND (1.4)             | -                       | ND (1.4)     | -                       | ND (1.4)     | -                       | ND (0.29)    | -                       | -                   |
| 2,4-Dichlorophenol                 | ug/l | 1                            | ND (1.3)     | -                       | ND (1.3)     | -                       | ND (1.3)             | -                       | ND (1.3)     | -                       | ND (1.3)     | -                       | ND (0.29)    | -                       | -                   |
| 2,4-Dimethylphenol                 | ug/l | 1                            | ND (1.3)     | -                       | ND (1.3)     | -                       | ND (1.3)             | -                       | ND (1.3)     | -                       | ND (1.3)     | -                       | ND (0.21)    | -                       | -                   |
| 2,4-Dinitrophenol                  | ug/l | 1                            | ND (1.1)     | -                       | ND (1.1)     | -                       | ND (1.1)             | -                       | ND (1.1)     | -                       | ND (1.1)     | -                       | ND (0.24)    | -                       | -                   |
| 4,6-Dinitro-o-cresol               | ug/l | -                            | ND (0.88)    | -                       | ND (0.90)    | -                       | ND (0.87)            | -                       | ND (0.87)    | -                       | ND (0.87)    | -                       | ND (0.34)    | -                       | -                   |
| 2-Methylphenol                     | ug/l | -                            | ND (0.83)    | -                       | ND (0.84)    | -                       | ND (0.82)            | -                       | ND (0.82)    | -                       | ND (0.82)    | -                       | ND (0.28)    | -                       | -                   |
| 3&4-Methylphenol                   | ug/l | -                            | ND (0.68)    | -                       | ND (0.69)    | -                       | ND (0.67)            | -                       | ND (0.67)    | -                       | ND (0.67)    | -                       | ND (0.46)    | -                       | -                   |
| 2-Nitrophenol                      | ug/l | -                            | ND (1.4)     | -                       | ND (1.5)     | -                       | ND (1.4)             | -                       | ND (1.4)     | -                       | ND (1.4)     | -                       | ND (0.31)    | -                       | -                   |
| 4-Nitrophenol                      | ug/l | -                            | ND (1.1)     | -                       | ND (1.1)     | -                       | ND (1.1)             | -                       | ND (1.1)     | -                       | ND (1.1)     | -                       | ND (0.29)    | -                       | -                   |
| Pentachlorophenol                  | ug/l | 1                            | ND (1.5)     | -                       | ND (1.5)     | -                       | ND (1.4)             | -                       | ND (1.4)     | -                       | ND (1.4)     | -                       | ND (0.23)    | -                       | -                   |
| Phenol                             | ug/l | 1                            | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.31)            | -                       | ND (0.31)    | -                       | ND (0.31)    | -                       | ND (0.34)    | -                       | -                   |
| 2,3,4,6-Tetrachlorophenol          | ug/l | -                            | ND (1.4)     | -                       | ND (1.5)     | -                       | ND (1.4)             | -                       | ND (1.4)     | -                       | ND (1.4)     | -                       | ND (0.36)    | -                       | -                   |
| 2,4,5-Trichlorophenol              | ug/l | -                            | ND (1.5)     | -                       | ND (1.5)     | -                       | ND (1.5)             | -                       | ND (1.5)     | -                       | ND (1.5)     | -                       | ND (1.5)     | -                       | -                   |
| 2,4,6-Trichlorophenol              | ug/l | -                            | ND (1.5)     | -                       | ND (1.5)     | -                       | ND (1.4)             | -                       | ND (1.4)     | -                       | ND (1.4)     | -                       | ND (1.4)     | -                       | -                   |
| Acenaphthene                       | ug/l | -                            | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| Acenaphthylene                     | ug/l | -                            | ND (0.24)    | -                       | ND (0.25)    | -                       | ND (0.24)            | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | -                   |
| Acetophenone                       | ug/l | -                            | ND (0.28)    | -                       | ND (0.28)    | -                       | ND (0.28)            | -                       | ND (0.28)    | -                       | ND (0.28)    | -                       | ND (0.28)    | -                       | -                   |
| Anthracene                         | ug/l | -                            | ND (0.25)    | -                       | ND (0.25)    | -                       | ND (0.25)            | -                       | ND (0.25)    | -                       | ND (0.25)    | -                       | ND (0.25)    | -                       | -                   |
| Atrazine                           | ug/l | 7.5                          | ND (0.42)    | -                       | ND (0.43)    | -                       | ND (0.42)            | -                       | ND (0.42)    | -                       | ND (0.42)    | -                       | ND (0.42)    | -                       | -                   |
| Benzaldehyde                       | ug/l | -                            | ND (0.34)    | -                       | ND (0.35)    | -                       | ND (0.34)            | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | -                   |
| Benzo(a)anthracene                 | ug/l | -                            | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.32)            | -                       | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.32)    | -                       | -                   |
| Benzo(a)pyrene                     | ug/l | ND                           | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (0.33)            | -                       | ND (0.33)    | -                       | ND (0.33)    | -                       | ND (0.33)    | -                       | -                   |
| Benzo(b)fluoranthene               | ug/l | -                            | ND (0.32)    | -                       | ND (0.33)    | -                       | ND (0.32)            | -                       | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.32)    | -                       | -                   |
| Benzo(g,h,i)perylene               | ug/l | -                            | ND (0.41)    | -                       | ND (0.42)    | -                       | ND (0.41)            | -                       | ND (0.41)    | -                       | ND (0.41)    | -                       | ND (0.41)    | -                       | -                   |
| Benzo(k)fluoranthene               | ug/l | -                            | ND (0.37)    | -                       | ND (0.38)    | -                       | ND (0.37)            | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | -                   |
| 4-Bromophenyl phenyl ether         | ug/l | -                            | ND (0.37)    | -                       | ND (0.38)    | -                       | ND (0.37)            | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | -                   |
| Butyl benzyl phthalate             | ug/l | -                            | ND (0.27)    | -                       | ND (0.28)    | -                       | ND (0.27)            | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | -                   |
| 1,1'-Biphenyl                      | ug/l | 5                            | ND (0.26)    | -                       | ND (0.26)    | -                       | ND (0.26)            | -                       | ND (0.26)    | -                       | ND (0.26)    | -                       | ND (0.26)    | -                       | -                   |
| 2-Chloronaphthalene                | ug/l | -                            | ND (0.30)    | -                       | ND (0.31)    | -                       | ND (0.30)            | -                       | ND (0.30)    | -                       | ND (0.30)    | -                       | ND (0.30)    | -                       | -                   |
| 4-Chloroaniline                    | ug/l | 5                            | ND (0.23)    | -                       | ND (0.24)    | -                       | ND (0.23)            | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | -                   |
| Carbazole                          | ug/l | -                            | ND (0.30)    | -                       | ND (0.30)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| Caprolactam                        | ug/l | -                            | ND (0.43)    | -                       | ND (0.44)    | -                       | ND (0.43)            | -                       | ND (0.43)    | -                       | ND (0.43)    | -                       | ND (0.43)    | -                       | -                   |
| Chrysene                           | ug/l | -                            | ND (0.35)    | -                       | ND (0.36)    | -                       | ND (0.35)            | -                       | ND (0.35)    | -                       | ND (0.35)    | -                       | ND (0.35)    | -                       | -                   |
| bis(2-Chloroethoxy)methane         | ug/l | 5                            | ND (0.26)    | -                       | ND (0.27)    | -                       | ND (0.26)            | -                       | ND (0.26)    | -                       | ND (0.26)    | -                       | ND (0.26)    | -                       | -                   |
| bis(2-Chloroethyl)ether            | ug/l | 1                            | ND (0.35)    | -                       | ND (0.35)    | -                       | ND (0.34)            | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | -                   |
| bis(2-Chloroisopropyl)ether        | ug/l | 5                            | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.28)            | -                       | ND (0.28)    | -                       | ND (0.28)    | -                       | ND (0.28)    | -                       | -                   |
| 4-Chlorophenyl phenyl ether        | ug/l | -                            | ND (0.27)    | -                       | ND (0.28)    | -                       | ND (0.27)            | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | -                   |
| 2,4-Dinitrotoluene                 | ug/l | 5                            | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.26)            | -                       | ND (0.26)    | -                       | ND (0.26)    | -                       | ND (0.26)    | -                       | -                   |
| 2,6-Dinitrotoluene                 | ug/l | 5                            | ND (0.33)    | -                       | ND (0.33)    | -                       | ND (0.32)            | -                       | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.32)    | -                       | -                   |
| 3,3'-Dichlorobenzidine             | ug/l | 5                            | ND (0.54)    | -                       | ND (0.55)    | -                       | ND (0.53)            | -                       | ND (0.53)    | -                       | ND (0.53)    | -                       | ND (0.53)    | -                       | -                   |
| 1,4-Dioxane                        | ug/l | -                            | ND (0.73)    | -                       | ND (0.74)    | -                       | ND (0.72)            | -                       | ND (0.72)    | -                       | ND (0.72)    | -                       | ND (0.72)    | -                       | -                   |
| Dibenzo(a,h)anthracene             | ug/l | -                            | ND (0.37)    | -                       | ND (0.38)    | -                       | ND (0.37)            | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | ND (0.37)    | -                       | -                   |
| Dibenzofuran                       | ug/l | -                            | ND (0.27)    | -                       | ND (0.28)    | -                       | ND (0.27)            | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | ND (0.27)    | -                       | -                   |
| Di-n-butyl phthalate               | ug/l | 50                           | ND (0.79)    | -                       | ND (0.81)    | -                       | ND (0.79)            | -                       | ND (0.79)    | -                       | ND (0.79)    | -                       | ND (0.79)    | -                       | -                   |
| Di-n-octyl phthalate               | ug/l | -                            | ND (0.29)    | -                       | ND (0.30)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| Diethyl phthalate                  | ug/l | -                            | ND (0.25)    | -                       | ND (0.25)    | -                       | ND (0.24)            | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | -                   |
| Dimethyl phthalate                 | ug/l | -                            | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.31)            | -                       | ND (0.31)    | -                       | ND (0.31)    | -                       | ND (0.31)    | -                       | -                   |
| bis(2-Ethylhexyl)phthalate         | ug/l | 5                            | ND (0.78)    | -                       | 1.4 J        | -                       | ND (0.77)            | -                       | ND (0.77)    | -                       | 3.8          | -                       | 1.5 J        | -                       | -                   |
| Fluoranthene                       | ug/l | -                            | ND (0.23)    | -                       | ND (0.24)    | -                       | ND (0.23)            | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | -                   |
| Fluorene                           | ug/l | -                            | ND (0.30)    | -                       | ND (0.30)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| Hexachlorobenzene                  | ug/l | 0.04                         | ND (0.43)    | -                       | ND (0.44)    | -                       | ND (0.42)            | -                       | ND (0.42)    | -                       | ND (0.42)    | -                       | ND (0.42)    | -                       | -                   |
| Hexachlorobutadiene                | ug/l | 0.5                          | ND (0.37)    | -                       | ND (0.38)    | -                       | ND (0.36)            | -                       | ND (0.36)    | -                       | ND (0.36)    | -                       | ND (0.36)    | -                       | -                   |
| Hexachlorocyclopentadiene          | ug/l | 5                            | ND (0.30)    | -                       | ND (0.30)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| Hexachloroethane                   | ug/l | 5                            | ND (0.22)    | -                       | ND (0.23)    | -                       | ND (0.22)            | -                       | ND (0.22)    | -                       | ND (0.22)    | -                       | ND (0.22)    | -                       | -                   |
| Indeno(1,2,3-cd)pyrene             | ug/l | -                            | ND (0.39)    | -                       | ND (0.40)    | -                       | ND (0.38)            | -                       | ND (0.38)    | -                       | ND (0.38)    | -                       | ND (0.38)    | -                       | -                   |
| Isophorone                         | ug/l | -                            | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| 2-Methylnaphthalene                | ug/l | -                            | ND (0.29)    | -                       | ND (0.30)    | -                       | ND (0.29)            | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -                   |
| 2-Nitroaniline                     | ug/l | 5                            | ND (0.21)    | -                       | ND (0.22)    | -                       | ND (0.21)            | -                       | ND (0.21)    | -                       | ND (0.21)    | -                       | ND (0.21)    | -                       | -                   |
| 3-Nitroaniline                     | ug/l | 5                            | ND (0.24)    | -                       | ND (0.25)    | -                       | ND (0.24)            | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | ND (0.24)    | -                       | -                   |

## Remaining Groundwater Exceedances

| Client Sample ID:               |      | NY TOGS Class<br><br>GA GW Standards<br>(NYSDEC 6/2004) <sup>1</sup> | MW-4         | MW-4                    | MW-3         | MW-3                    | FB-1        | FB-1        | MW-201       | MW-201                  | MW-2         | MW-2                    | MW-1         | MW-1                    | TRIP BLANK |
|---------------------------------|------|----------------------------------------------------------------------|--------------|-------------------------|--------------|-------------------------|-------------|-------------|--------------|-------------------------|--------------|-------------------------|--------------|-------------------------|------------|
| Lab Sample ID:                  |      |                                                                      | JC12052-1    | JC12052-1F              | JC12052-2    | JC12052-2F              | JC12052-3   | JC12052-3F  | JC12052-4    | JC12052-4F              | JC12052-5    | JC12052-5F              | JC12052-6    | JC12052-6F              | JC12052-7  |
| Date Sampled:                   |      |                                                                      | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016    | 5/1/2016    | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016     | 5/1/2016                | 5/1/2016   |
| Matrix:                         |      |                                                                      | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Field Blank | Field Blank | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Ground Water | Groundwater<br>Filtered | Water      |
| 4-Nitroaniline                  | ug/l | 5                                                                    | ND (0.35)    | -                       | ND (0.35)    | -                       | ND (0.34)   | -           | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | -          |
| Naphthalene                     | ug/l | -                                                                    | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.28)   | -           | ND (0.28)    | -                       | ND (0.28)    | -                       | ND (0.28)    | -                       | -          |
| Nitrobenzene                    | ug/l | 0.4                                                                  | ND (0.47)    | -                       | ND (0.48)    | -                       | ND (0.46)   | -           | ND (0.46)    | -                       | ND (0.46)    | -                       | ND (0.46)    | -                       | -          |
| N-Nitroso-di-n-propylamine      | ug/l | -                                                                    | ND (0.32)    | -                       | ND (0.32)    | -                       | ND (0.31)   | -           | ND (0.31)    | -                       | ND (0.31)    | -                       | ND (0.31)    | -                       | -          |
| N-Nitrosodiphenylamine          | ug/l | -                                                                    | ND (0.30)    | -                       | ND (0.30)    | -                       | ND (0.29)   | -           | ND (0.29)    | -                       | ND (0.29)    | -                       | ND (0.29)    | -                       | -          |
| Phenanthrene                    | ug/l | -                                                                    | ND (0.23)    | -                       | ND (0.24)    | -                       | ND (0.23)   | -           | ND (0.23)    | -                       | ND (0.23)    | -                       | ND (0.23)    | -                       | -          |
| Pyrene                          | ug/l | -                                                                    | ND (0.34)    | -                       | ND (0.35)    | -                       | ND (0.34)   | -           | ND (0.34)    | -                       | ND (0.34)    | -                       | ND (0.34)    | -                       | -          |
| 1,2,4,5-Tetrachlorobenzene      | ug/l | 5                                                                    | ND (0.37)    | -                       | ND (0.37)    | -                       | ND (0.36)   | -           | ND (0.36)    | -                       | ND (0.36)    | -                       | ND (0.36)    | -                       | -          |
| GC Semi-volatiles (SW846 8081B) |      |                                                                      |              |                         |              |                         |             |             |              |                         |              |                         |              |                         |            |
| Aldrin                          | ug/l | ND                                                                   | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029) | -           | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029)  | -                       | -          |
| alpha-BHC                       | ug/l | 0.01                                                                 | ND (0.0023)  | -                       | ND (0.0023)  | -                       | ND (0.0023) | -           | ND (0.0023)  | -                       | ND (0.0023)  | -                       | ND (0.0023)  | -                       | -          |
| beta-BHC                        | ug/l | 0.04                                                                 | ND (0.0026)  | -                       | ND (0.0026)  | -                       | ND (0.0026) | -           | ND (0.0026)  | -                       | ND (0.0026)  | -                       | ND (0.0026)  | -                       | -          |
| delta-BHC                       | ug/l | 0.04                                                                 | ND (0.0032)  | -                       | ND (0.0032)  | -                       | ND (0.0032) | -           | ND (0.0032)  | -                       | ND (0.0032)  | -                       | ND (0.0032)  | -                       | -          |
| gamma-BHC (Lindane)             | ug/l | 0.05                                                                 | ND (0.0028)  | -                       | ND (0.0028)  | -                       | ND (0.0028) | -           | ND (0.0028)  | -                       | ND (0.0028)  | -                       | ND (0.0028)  | -                       | -          |
| alpha-Chlordane                 | ug/l | -                                                                    | ND (0.0025)  | -                       | ND (0.0025)  | -                       | ND (0.0025) | -           | ND (0.0025)  | -                       | ND (0.0025)  | -                       | ND (0.0025)  | -                       | -          |
| gamma-Chlordane                 | ug/l | -                                                                    | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029) | -           | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029)  | -                       | -          |
| Dieldrin                        | ug/l | 0.004                                                                | ND (0.0020)  | -                       | ND (0.0020)  | -                       | ND (0.0020) | -           | ND (0.0020)  | -                       | ND (0.0020)  | -                       | ND (0.0020)  | -                       | -          |
| 4,4'-DDD                        | ug/l | 0.3                                                                  | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029) | -           | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029)  | -                       | -          |
| 4,4'-DDE                        | ug/l | 0.2                                                                  | ND (0.0027)  | -                       | ND (0.0027)  | -                       | ND (0.0027) | -           | ND (0.0027)  | -                       | ND (0.0027)  | -                       | ND (0.0027)  | -                       | -          |
| 4,4'-DDT                        | ug/l | 0.2                                                                  | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029) | -           | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029)  | -                       | -          |
| Endrin                          | ug/l | ND                                                                   | ND (0.0022)  | -                       | ND (0.0022)  | -                       | ND (0.0022) | -           | ND (0.0022)  | -                       | ND (0.0022)  | -                       | ND (0.0022)  | -                       | -          |
| Endosulfan sulfate              | ug/l | -                                                                    | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029) | -           | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029)  | -                       | -          |
| Endrin aldehyde                 | ug/l | 5                                                                    | ND (0.0032)  | -                       | ND (0.0032)  | -                       | ND (0.0032) | -           | ND (0.0032)  | -                       | ND (0.0032)  | -                       | ND (0.0032)  | -                       | -          |
| Endrin ketone                   | ug/l | 5                                                                    | ND (0.0023)  | -                       | ND (0.0023)  | -                       | ND (0.0023) | -           | ND (0.0023)  | -                       | ND (0.0023)  | -                       | ND (0.0023)  | -                       | -          |
| Endosulfan-I                    | ug/l | -                                                                    | ND (0.0022)  | -                       | ND (0.0022)  | -                       | ND (0.0022) | -           | ND (0.0022)  | -                       | ND (0.0022)  | -                       | ND (0.0022)  | -                       | -          |
| Endosulfan-II                   | ug/l | -                                                                    | ND (0.0026)  | -                       | ND (0.0026)  | -                       | ND (0.0026) | -           | ND (0.0026)  | -                       | ND (0.0026)  | -                       | ND (0.0026)  | -                       | -          |
| Heptachlor                      | ug/l | 0.04                                                                 | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029) | -           | ND (0.0029)  | -                       | ND (0.0029)  | -                       | ND (0.0029)  | -                       | -          |
| Heptachlor epoxide              | ug/l | 0.03                                                                 | ND (0.0026)  | -                       | ND (0.0026)  | -                       | ND (0.0026) | -           | ND (0.0026)  | -                       | ND (0.0026)  | -                       | ND (0.0026)  | -                       | -          |
| Methoxychlor                    | ug/l | 35                                                                   | ND (0.0022)  | -                       | ND (0.0022)  | -                       | ND (0.0022) | -           | ND (0.0022)  | -                       | ND (0.0022)  | -                       | ND (0.0022)  | -                       | -          |
| Toxaphene                       | ug/l | 0.06                                                                 | ND (0.088)   | -                       | ND (0.088)   | -                       | ND (0.088)  | -           | ND (0.088)   | -                       | ND (0.088)   | -                       | ND (0.088)   | -                       | -          |

Table 3  
Remaining Groundwater Exceedances

[illegible]

Table 4  
Soil Vapor Exceedances

| Client Sample ID:                    | SG-1             | SG-2             | SG-3             | SG-4             | SG-5             | SG-6             | SS-10            | SS-11            | SS-12            | SS-13            | SS-14            |
|--------------------------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|
| Lab Sample ID:                       | JC17272-4        | JC17272-5        | JC17272-6        | JC17272-2        | JC17272-1        | JC17272-3        | JC11091-1        | JC11091-2        | JC11091-5        | JC11091-4        | JC11091-3        |
| Date Sampled:                        | 10/28/2015       | 10/28/2015       | 10/28/2015       | 10/28/2015       | 10/28/2015       | 10/28/2015       | 12/17/2015       | 12/17/2015       | 12/17/2015       | 12/17/2015       | 12/17/2015       |
| Matrix:                              | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. | Soil Vapor Comp. |
| GC/MS Volatiles (TO-15) - ug/m3      |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |
| Acetone                              | ug/m3            | 54.6             | 109              | 31.6             | 110              | 208              | 54.6             |                  |                  |                  |                  |
| 1,3-Butadiene                        | ug/m3            | ND (0.27)        | ND (0.27)        | ND (0.27)        | ND (0.27)        | ND (0.27)        | ND (0.27)        |                  |                  |                  |                  |
| Benzene                              | ug/m3            | 5.1              | 2.7              | 2.6              | 5.1              | 24               | 4.8              |                  |                  |                  |                  |
| Bromochloromethane                   | ug/m3            | ND (0.87)        | ND (0.87)        | ND (0.87)        | ND (0.87)        | ND (0.87)        | ND (0.87)        |                  |                  |                  |                  |
| Bromoforn                            | ug/m3            | ND (0.85)        | ND (0.85)        | ND (0.85)        | ND (0.85)        | ND (0.85)        | ND (0.85)        |                  |                  |                  |                  |
| Bromomethane                         | ug/m3            | ND (0.34)        | ND (0.34)        | ND (0.34)        | ND (0.34)        | ND (0.34)        | ND (0.34)        |                  |                  |                  |                  |
| Bromoethane                          | ug/m3            | ND (0.35)        | ND (0.35)        | ND (0.35)        | ND (0.35)        | ND (0.35)        | ND (0.35)        |                  |                  |                  |                  |
| Benzyl Chloride                      | ug/m3            | ND (0.52)        | ND (0.52)        | ND (0.52)        | ND (0.52)        | ND (0.52)        | ND (0.52)        |                  |                  |                  |                  |
| Carbon disulfide                     | ug/m3            | ND (0.34)        | 3.4              | 3.2              | 10               | 2.2              | 6.1              |                  |                  |                  |                  |
| Chlorobenzene                        | ug/m3            | ND (0.60)        | ND (0.60)        | ND (0.60)        | ND (0.60)        | ND (0.60)        | ND (0.60)        |                  |                  |                  |                  |
| Chloroethane                         | ug/m3            | ND (0.23)        | ND (0.23)        | ND (0.23)        | ND (0.23)        | ND (0.23)        | ND (0.23)        |                  |                  |                  |                  |
| Chloroform                           | ug/m3            | 38               | 59               | 44               | ND (0.59)        | ND (0.59)        | ND (0.59)        |                  |                  |                  |                  |
| Chloromethane                        | ug/m3            | ND (0.25)        | ND (0.25)        | ND (0.25)        | ND (0.25)        | ND (0.25)        | ND (0.25)        |                  |                  |                  |                  |
| 3-Chloropropene                      | ug/m3            | ND (0.34)        | ND (0.34)        | ND (0.34)        | ND (0.34)        | ND (0.34)        | ND (0.34)        |                  |                  |                  |                  |
| 2-Chlorotoluene                      | ug/m3            | ND (0.67)        | ND (0.67)        | ND (0.67)        | ND (0.67)        | ND (0.67)        | ND (0.67)        |                  |                  |                  |                  |
| Carbon tetrachloride                 | ug/m3            | ND (0.67)        | ND (0.67)        | ND (0.67)        | ND (0.67)        | ND (0.67)        | ND (0.67)        |                  |                  |                  |                  |
| Cyclohexane                          | ug/m3            | ND (0.45)        | ND (0.45)        | ND (0.45)        | ND (0.45)        | ND (0.45)        | ND (0.45)        |                  |                  |                  |                  |
| 1,1-Dichloroethane                   | ug/m3            | 19               | 31               | 5.3              | ND (0.49)        | ND (0.49)        | ND (0.49)        |                  |                  |                  |                  |
| 1,1-Dichloroethylene                 | ug/m3            | 76.1             | 181              | 90.8             | ND (0.44)        | ND (0.44)        | ND (0.44)        |                  |                  |                  |                  |
| 1,2-Dibromomethane                   | ug/m3            | ND (1.1)         | 5.3              | 1                | ND (1.1)         | ND (1.1)         | ND (1.1)         |                  |                  |                  |                  |
| 1,2-Dichlorobenzene                  | ug/m3            | ND (0.60)        | ND (0.40)        | ND (0.40)        | ND (0.40)        | ND (0.40)        | ND (0.40)        |                  |                  |                  |                  |
| 1,2-Dichloropropene                  | ug/m3            | ND (0.92)        | ND (0.92)        | ND (0.92)        | ND (0.92)        | ND (0.92)        | ND (0.92)        |                  |                  |                  |                  |
| 1,4-Dioxane                          | ug/m3            | ND (0.90)        | ND (0.90)        | ND (0.90)        | ND (0.90)        | ND (0.90)        | ND (0.90)        |                  |                  |                  |                  |
| Dichlorodifluoromethane              | ug/m3            | 8.2              | 34.1             | 4.2              | 3.1              | 5.4              | 4                |                  |                  |                  |                  |
| Dibromochloromethane                 | ug/m3            | ND (1.4)         | ND (1.4)         | ND (1.4)         | ND (1.4)         | ND (1.4)         | ND (1.4)         |                  |                  |                  |                  |
| trans-1,2-Dichloroethylene           | ug/m3            | 3.8              | 5.9              | ND (0.32)        | ND (0.32)        | ND (0.32)        | ND (0.32)        |                  |                  |                  |                  |
| cis-1,2-Dichloroethylene             | ug/m3            | 101              | 269              | ND (0.39)        | ND (0.39)        | ND (0.39)        | ND (0.39)        |                  |                  |                  |                  |
| cis-1,3-Dichloropropene              | ug/m3            | ND (0.64)        | ND (0.64)        | ND (0.64)        | ND (0.64)        | ND (0.64)        | ND (0.64)        |                  |                  |                  |                  |
| m-Dichlorobenzene                    | ug/m3            | ND (0.66)        | ND (0.66)        | ND (0.66)        | ND (0.66)        | ND (0.66)        | ND (0.66)        |                  |                  |                  |                  |
| o-Dichlorobenzene                    | ug/m3            | ND (0.72)        | ND (0.72)        | ND (0.72)        | ND (0.72)        | ND (0.72)        | ND (0.72)        |                  |                  |                  |                  |
| p-Dichlorobenzene                    | ug/m3            | 46               | ND (0.46)        | ND (0.46)        | ND (0.46)        | ND (0.46)        | ND (0.46)        |                  |                  |                  |                  |
| trans-1,3-Dichloropropene            | ug/m3            | ND (0.37)        | ND (0.37)        | ND (0.37)        | ND (0.37)        | ND (0.37)        | ND (0.37)        |                  |                  |                  |                  |
| Ethanol                              | ug/m3            | 40.3             | 33.2             | 14               | 14               | 14               | 9.6              |                  |                  |                  |                  |
| Ethylbenzene                         | ug/m3            | ND (0.83)        | 3.0              | 6.9              | 2.1              | 6.1              | 17.1             |                  |                  |                  |                  |
| Ethyl Acetate                        | ug/m3            | ND (0.90)        | ND (0.90)        | ND (0.90)        | 3.4              | ND (0.90)        | ND (0.90)        |                  |                  |                  |                  |
| 4-Ethyltoluene                       | ug/m3            | ND (0.43)        | ND (0.43)        | ND (0.43)        | ND (0.43)        | ND (0.43)        | ND (0.43)        |                  |                  |                  |                  |
| Freon 113                            | ug/m3            | ND (0.84)        | ND (0.84)        | ND (0.84)        | ND (0.84)        | ND (0.84)        | ND (0.84)        |                  |                  |                  |                  |
| Freon 114                            | ug/m3            | ND (0.70)        | ND (0.70)        | ND (0.70)        | ND (0.70)        | ND (0.70)        | ND (0.70)        |                  |                  |                  |                  |
| Heptane                              | ug/m3            | 142              | 17.4             | 3.9              | 5.3              | 126              | ND (0.49)        |                  |                  |                  |                  |
| Heptachlorobutadiene                 | ug/m3            | ND (1.4)         | ND (1.4)         | ND (1.4)         | ND (1.4)         | ND (1.4)         | ND (1.4)         |                  |                  |                  |                  |
| Hexane                               | ug/m3            | 3.9              | 3.3              | 3                | 11               | 277              | 2.1              |                  |                  |                  |                  |
| 2-Hexanone                           | ug/m3            | ND (0.74)        | ND (0.74)        | ND (0.74)        | ND (0.74)        | ND (0.74)        | ND (0.74)        |                  |                  |                  |                  |
| Isopropyl Alcohol                    | ug/m3            | 3.9              | 3.2              | 1.7              | 2.7              | 2.9              | 1.8              |                  |                  |                  |                  |
| Methylene chloride                   | ug/m3            | 5.2              | 4.5              | 4.3              | 4.2              | 3.4              | 3.4              |                  |                  |                  |                  |
| Methyl ethyl ketone                  | ug/m3            | 3.8              | 2.0              | 2.9              | 16               | 49.3             | 5.6              |                  |                  |                  |                  |
| Methyl Isobutyl Ketone               | ug/m3            | ND (0.45)        | 6.6              | 2.1              | 3                | ND (0.45)        | ND (0.45)        |                  |                  |                  |                  |
| Methyl Tert Butyl Ether              | ug/m3            | ND (0.36)        | ND (0.36)        | 8                | ND (0.36)        | ND (0.36)        | ND (0.36)        |                  |                  |                  |                  |
| Methylmethacrylate                   | ug/m3            | ND (0.49)        | ND (0.49)        | ND (0.49)        | ND (0.49)        | ND (0.49)        | ND (0.49)        |                  |                  |                  |                  |
| Propylene                            | ug/m3            | 6.4              | 22.3             | 22               | 129              | 3960             | 4                |                  |                  |                  |                  |
| Styrene                              | ug/m3            | ND (0.43)        | ND (0.43)        | ND (0.43)        | ND (0.43)        | ND (0.43)        | ND (0.43)        |                  |                  |                  |                  |
| 1,1,1-Trichloroethane                | ug/m3            | 91               | 278              | 24               | 24               | 163              | 16.3             |                  |                  |                  |                  |
| 1,1,2,2-Tetrachloroethane            | ug/m3            | ND (0.82)        | ND (0.82)        | ND (0.82)        | ND (0.82)        | ND (0.82)        | ND (0.82)        |                  |                  |                  |                  |
| 1,1,2-Trichloroethane                | ug/m3            | ND (0.76)        | ND (0.76)        | ND (0.76)        | ND (0.76)        | ND (0.76)        | ND (0.76)        |                  |                  |                  |                  |
| 1,2,4-Trichlorobenzene               | ug/m3            | ND (1.3)         | ND (1.3)         | ND (1.3)         | ND (1.3)         | ND (1.3)         | ND (1.3)         |                  |                  |                  |                  |
| 1,2,4-Trimethylbenzene               | ug/m3            | ND (0.45)        | ND (0.45)        | ND (0.45)        | ND (0.45)        | ND (0.45)        | ND (0.45)        |                  |                  |                  |                  |
| 3,5-Trimethylbenzene                 | ug/m3            | ND (0.59)        | ND (0.59)        | ND (0.59)        | ND (0.59)        | ND (0.59)        | ND (0.59)        |                  |                  |                  |                  |
| 2,4,6-Trimethylbenzene               | ug/m3            | 377              | ND (0.40)        | ND (0.40)        | ND (0.40)        | ND (0.40)        | ND (0.40)        |                  |                  |                  |                  |
| Tertiary Butyl Alcohol               | ug/m3            | 8.8              | 7.3              | 4.2              | 4.5              | ND (0.61)        | 5.8              |                  |                  |                  |                  |
| Tetrachloroethylene                  | ug/m3            | 66               | 2870             | 79               | 86               | 142              | 142              | ND (0.64)        | 7.3              | 5.8              | 0.75 J           |
| Tetrahydrofuran                      | ug/m3            | ND (0.50)        | ND (0.50)        | ND (0.50)        | ND (0.50)        | ND (0.50)        | ND (0.50)        |                  |                  |                  | 2                |
| Toluene                              | ug/m3            | 5.3              | 4.5              | 4.9              | 7.2              | 31               | 4.9              |                  |                  |                  |                  |
| Trichloroethylene                    | ug/m3            | 1980             | 3510             | 688              | 21               | 21               | 1.35             | 31               | 23               | 3.4              | 18               |
| Trichlorofluoromethane               | ug/m3            | 27               | 57               | 114              | 27               | 39               | 39               |                  |                  |                  |                  |
| Vinyl chloride                       | ug/m3            | ND (0.33)        | ND (0.33)        | ND (0.33)        | ND (0.33)        | ND (0.33)        | ND (0.33)        |                  |                  |                  |                  |
| Vinyl Acetate                        | ug/m3            | ND (0.77)        | ND (0.77)        | ND (0.77)        | ND (0.77)        | ND (0.77)        | ND (0.77)        |                  |                  |                  |                  |
| m,p-Xylene                           | ug/m3            | 3.0              | 11               | 26               | 6.1              | 13               | 4.3              |                  |                  |                  |                  |
| o-Xylene                             | ug/m3            | ND (0.43)        | 4.3              | 15               | 2.5              | 4.8              | 17.7             |                  |                  |                  |                  |
| Xylenes (total)                      | ug/m3            | 3.0              | 15               | 41               | 8.7              | 18               | 6.1              |                  |                  |                  |                  |
| Shaded cells show detected compounds |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |                  |



**APPENDIX A**  
**ENVIRONMENTAL EASEMENT**

**ENVIRONMENTAL EASEMENT GRANTED PURSUANT TO ARTICLE 71, TITLE 36  
OF THE NEW YORK STATE ENVIRONMENTAL CONSERVATION LAW**

**THIS INDENTURE** made this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_, between Owner(s) Williamsburg Bridgeview Apartments Housing Development Fund Corporation, (the "Grantor Fee Owner") having an office at 143 Huron Street, Brooklyn, New York 11222, County of Kings, State of New York, and LPC Development Group LLC, (the "Grantor Beneficial Owner), having an office at 456 E. 173rd Street, Bronx, New York 10457, County of Bronx, State of New York (collectively, the "Grantor"), and The People of the State of New York (the "Grantee."), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

**WHEREAS**, the Legislature of the State of New York has declared that it is in the public interest to encourage the remediation of abandoned and likely contaminated properties ("sites") that threaten the health and vitality of the communities they burden while at the same time ensuring the protection of public health and the environment; and

**WHEREAS**, the Legislature of the State of New York has declared that it is in the public interest to establish within the Department a statutory environmental remediation program that includes the use of Environmental Easements as an enforceable means of ensuring the performance of operation, maintenance, and/or monitoring requirements and the restriction of future uses of the land, when an environmental remediation project leaves residual contamination at levels that have been determined to be safe for a specific use, but not all uses, or which includes engineered structures that must be maintained or protected against damage to perform properly and be effective, or which requires groundwater use or soil management restrictions; and

**WHEREAS**, the Legislature of the State of New York has declared that Environmental Easement shall mean an interest in real property, created under and subject to the provisions of Article 71, Title 36 of the New York State Environmental Conservation Law ("ECL") which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls which are intended to ensure the long term effectiveness of a site remedial program or eliminate potential exposure pathways to hazardous waste or petroleum; and

**WHEREAS**, Grantor, is the owner of real property located at the address of 105 S. 5th Street in the City of New York, County of Kings and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 2443 Lot 6, being the same as that property conveyed to Grantor by deed dated June 29, 2016 and recorded in the City Register of the City of New York in Instrument No. 2016000239363. The property subject to this Environmental Easement (the "Controlled Property") comprises approximately 0.366 +/- acres, and is hereinafter more fully described in the Land Title Survey dated June 18, 2018 prepared by Neville V. Ramsay, L.L.S., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A;

**WHEREAS**, Grantor Beneficial Owner, is the owner of the beneficial interest in the

Controlled Property being the same as a portion of that beneficial interest conveyed to Grantor Beneficial Owner by means of a Declaration of Interest and Nominee Agreement dated June 29, 2016 and recorded in the City Register of the City of New York in Instrument No. 2016000239364; and

**WHEREAS**, the Department accepts this Environmental Easement in order to ensure the protection of public health and the environment and to achieve the requirements for remediation established for the Controlled Property until such time as this Environmental Easement is extinguished pursuant to ECL Article 71, Title 36; and

**NOW THEREFORE**, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C224233-06-16, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement")

1. **Purposes.** Grantor and Grantee acknowledge that the Purposes of this Environmental Easement are: to convey to Grantee real property rights and interests that will run with the land in perpetuity in order to provide an effective and enforceable means of encouraging the reuse and redevelopment of this Controlled Property at a level that has been determined to be safe for a specific use while ensuring the performance of operation, maintenance, and/or monitoring requirements; and to ensure the restriction of future uses of the land that are inconsistent with the above-stated purpose.

2. **Institutional and Engineering Controls.** The controls and requirements listed in the Department approved Site Management Plan ("SMP") including any and all Department approved amendments to the SMP are incorporated into and made part of this Environmental Easement. These controls and requirements apply to the use of the Controlled Property, run with the land, are binding on the Grantor and the Grantor's successors and assigns, and are enforceable in law or equity against any owner of the Controlled Property, any lessees and any person using the Controlled Property.

A. (1) The Controlled Property may be used for:

**Restricted Residential as described in 6 NYCRR Part 375-1.8(g)(2)(ii),  
Commercial as described in 6 NYCRR Part 375-1.8(g)(2)(iii) and Industrial  
as described in 6 NYCRR Part 375-1.8(g)(2)(iv)**

(2) All Engineering Controls must be operated and maintained as specified in the Site Management Plan (SMP);

(3) All Engineering Controls must be inspected at a frequency and in a manner defined in the SMP;

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the

Department;

(5) Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;

(6) Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in the SMP;

(7) All future activities on the property that will disturb remaining contaminated material must be conducted in accordance with the SMP;

(8) Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in the SMP;

(9) Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical components of the remedy shall be performed as defined in the SMP;

(10) Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by this Environmental Easement.

B. The Controlled Property shall not be used for Residential purposes as defined in 6NYCRR 375-1.8(g)(2)(i), and the above-stated engineering controls may not be discontinued without an amendment or extinguishment of this Environmental Easement.

C. The SMP describes obligations that the Grantor assumes on behalf of Grantor, its successors and assigns. The Grantor's assumption of the obligations contained in the SMP which may include sampling, monitoring, and/or operating a treatment system, and providing certified reports to the NYSDEC, is and remains a fundamental element of the Department's determination that the Controlled Property is safe for a specific use, but not all uses. The SMP may be modified in accordance with the Department's statutory and regulatory authority. The Grantor and all successors and assigns, assume the burden of complying with the SMP and obtaining an up-to-date version of the SMP from:

Site Control Section  
Division of Environmental Remediation  
NYSDEC  
625 Broadway  
Albany, New York 12233  
Phone: (518) 402-9553

D. Grantor must provide all persons who acquire any interest in the Controlled Property a true and complete copy of the SMP that the Department approves for the Controlled Property and all Department-approved amendments to that SMP.

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property

shall state in at least fifteen-point bold-faced type:

**This property is subject to an Environmental Easement held by the New York State Department of Environmental Conservation pursuant to Title 36 of Article 71 of the Environmental Conservation Law.**

F. Grantor covenants and agrees that this Environmental Easement shall be incorporated in full or by reference in any leases, licenses, or other instruments granting a right to use the Controlled Property.

G. Grantor covenants and agrees that it shall, at such time as NYSDEC may require, submit to NYSDEC a written statement by an expert the NYSDEC may find acceptable certifying under penalty of perjury, in such form and manner as the Department may require, that:

- (1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).
- (2) the institutional controls and/or engineering controls employed at such site:
  - (i) are in-place;
  - (ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and
  - (iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;
- (3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;
- (4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;
- (5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;
- (6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and
- (7) the information presented is accurate and complete.

3. Right to Enter and Inspect. Grantee, its agents, employees, or other representatives of the State may enter and inspect the Controlled Property in a reasonable manner and at reasonable times to assure compliance with the above-stated restrictions.

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and successors in interest with respect to the Property, all rights as fee owner of the Property, including:

- A. Use of the Controlled Property for all purposes not inconsistent with, or limited by

**the terms of this Environmental Easement;**

B. The right to give, sell, assign, or otherwise transfer part or all of the underlying fee interest to the Controlled Property, subject and subordinate to this Environmental Easement;

## 5. Enforcement

A. This Environmental Easement is enforceable in law or equity in perpetuity by Grantor, Grantee, or any affected local government, as defined in ECL Section 71-3603, against the owner of the Property, any lessees, and any person using the land. Enforcement shall not be defeated because of any subsequent adverse possession, laches, estoppel, or waiver. It is not a defense in any action to enforce this Environmental Easement that: it is not appurtenant to an interest in real property; it is not of a character that has been recognized traditionally at common law; it imposes a negative burden; it imposes affirmative obligations upon the owner of any interest in the burdened property; the benefit does not touch or concern real property; there is no privity of estate or of contract; or it imposes an unreasonable restraint on alienation.

B. If any person violates this Environmental Easement, after applicable notice and cure period, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

C. Grantee shall notify Grantor of a breach or suspected breach of any of the terms of this Environmental Easement. Such notice shall set forth how Grantor can cure such breach or suspected breach and give Grantor a reasonable amount of time from the date of receipt of notice in which to cure. At the expiration of such period of time to cure, or any extensions granted by Grantee, the Grantee shall notify Grantor of any failure to adequately cure the breach or suspected breach, and Grantee may take any other appropriate action reasonably necessary to remedy any breach of this Environmental Easement, including the commencement of any proceedings in accordance with applicable law.

D. The failure of Grantee to enforce any of the terms contained herein shall not be deemed a waiver of any such term nor bar any enforcement rights.

6. Notice. Whenever notice to the Grantee (other than the annual certification) or approval from the Grantee is required, the Party providing such notice or seeking such approval shall identify the Controlled Property by referencing the following information:

County, NYSDEC Site Number, NYSDEC Brownfield Cleanup Agreement, State Assistance Contract or Order Number, and the County tax map number or the Liber and Page or computerized system identification number.

Parties shall address correspondence to: Site Number: C224233  
Office of General Counsel  
NYSDEC  
625 Broadway  
Albany New York 12233-5500

With a copy to: Site Control Section

Division of Environmental Remediation  
NYSDEC  
625 Broadway  
Albany, NY 12233

All notices and correspondence shall be delivered by hand, by registered mail or by Certified mail and return receipt requested. The Parties may provide for other means of receiving and communicating notices and responses to requests for approval.

7. Recordation. Grantor shall record this instrument, within thirty (30) days of execution of this instrument by the Commissioner or her/his authorized representative in the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

8. Amendment. Any amendment to this Environmental Easement may only be executed by the Commissioner of the New York State Department of Environmental Conservation or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

9. Extinguishment. This Environmental Easement may be extinguished only by a release by the Commissioner of the New York State Department of Environmental Conservation, or the Commissioner's Designee, and filed with the office of the recording officer for the county or counties where the Property is situated in the manner prescribed by Article 9 of the Real Property Law.

10. Joint Obligation. If there are two or more parties identified as Grantor herein, the obligations imposed by this instrument upon them shall be joint and several.

11. Consistency with the SMP. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, regarding matters specifically addressed by the SMP, the terms of the SMP will control.

Remainder of Page Intentionally Left Blank

IN WITNESS WHEREOF, Grantor Fee Owner has caused this instrument to be signed in its name.

Corporation: Williamsburg Bridgeview Apartments Housing Development Fund

By: 

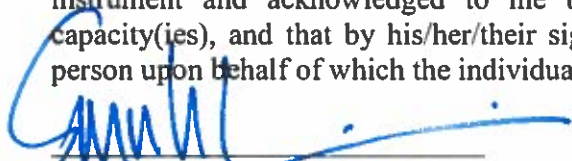
Print Name: RICHARD MAZUR

Title: President Date: 8/16/18

Grantor Fee Owner's Acknowledgment

STATE OF NEW YORK )  
 ) ss:  
COUNTY OF BRONX )

On the 20 day of August, in the year 2018, before me, the undersigned, personally appeared RICHARD MAZUR personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

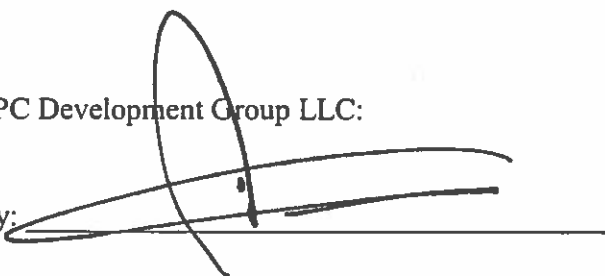
  
Notary Public - State of New York

SARAH M.N. WILLIAMS  
Notary Public, State of New York  
Qualified in New York County  
No. 02WI6133522  
Commission Expires September 19, 2021



IN WITNESS WHEREOF, Grantor Beneficial Owner has caused this instrument to be signed in its name.

LPC Development Group LLC:

By: 

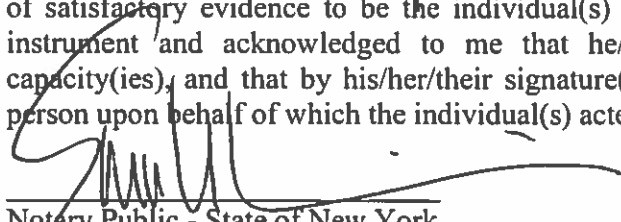
Print Name: MARIO PROCHIDA

Title: MANAGER Date: 8.15.18

**Grantor Beneficial Owner's Acknowledgment**

STATE OF NEW YORK     )  
                                          ) ss:  
COUNTY OF                     )

On the 15 day of August, in the year 2018, before me, the undersigned, personally appeared MARIO PROCHIDA, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

  
Notary Public - State of New York

**SARAH M.N. WILLIAMS**  
Notary Public, State of New York  
Qualified in New York County  
No. 02W18133522  
Commission Expires September 19, 2021

**THIS ENVIRONMENTAL EASEMENT IS HEREBY ACCEPTED BY THE PEOPLE OF THE STATE OF NEW YORK**, Acting By and Through the Department of Environmental Conservation as Designee of the Commissioner,

By: \_\_\_\_\_

Michael J. Ryan, Director  
Division of Environmental Remediation

**Grantee's Acknowledgment**

STATE OF NEW YORK     )  
                                          ) ss:  
COUNTY OF ALBANY     )

On the \_\_\_\_\_ day of \_\_\_\_\_, in the year 20\_\_, before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

\_\_\_\_\_  
Notary Public - State of New York

\_\_\_\_\_

**SCHEDULE "A" PROPERTY DESCRIPTION**

ALL that certain plot, piece or parcel of land, situate, lying and being in the Borough of Brooklyn, County of Kings, City and State of New York, bounded and described as follows:

BEGINNING at a point on the easterly side of Berry Street distant 90.00 feet southerly from the corner formed by the intersection of the easterly side of Berry Street with the southerly side of South 4th Street;

RUNNING THENCE easterly at 90 degrees to the easterly side of Berry Street and parallel to the southerly side of South 4th Street, 18.67 feet;

THENCE southwesterly forming an interior angle of 97 degrees 35 minutes 54 seconds with the last mentioned course 10.09 feet (survey), 10.15 feet (tax map);

THENCE southeasterly forming an interior angle of 262 degrees 24 minutes 06 seconds with the last mentioned course and parallel with the southerly side of South 4th Street, 141.00 feet;

THENCE southwesterly forming an interior angle of 90 degrees with the last mentioned course and parallel to the easterly side of Berry Street, 44.00 feet;

THENCE southeasterly forming an interior angle of 270 degrees 00 minutes 00 seconds with the last mentioned course and parallel with the southerly side of South 4th Street, 42.50 feet;

THENCE southwesterly forming an interior angle of 90 degrees with the last mentioned course and parallel to the easterly side of Berry Street, 77.89 feet (survey), 77.73 (tax map) to the northerly side of South 5th Street as widened;

THENCE northwesterly forming an interior angle of 93 degrees 57 minutes 02 seconds with the last mentioned course and along the northerly side of said South 5th Street 125.22 feet (survey) 125.21 (tax map);

THENCE northeasterly forming an interior angle of 85 degrees 58 minutes 55 seconds (computed) 46.88 feet (survey) 46.87 feet (tax map);

THENCE southeasterly forming an interior angle of 91 degrees 20 minutes 00 seconds with the last mentioned course, 25.00 feet;

THENCE northeasterly forming an interior angle of 268 degrees 40 minutes 04 seconds 46.25 feet (survey), 45.25 feet (tax map);

THENCE northwesterly forming an interior angle of 271 degrees 23 minutes 59 seconds with the last mentioned course 103.71 feet (survey), 103.67 (tax map) to the easterly side of Berry Street;

THENCE northeasterly along the easterly side of Berry Street forming an interior angle of 88 degrees 40 minutes 00 seconds with the last mentioned course 49.25 feet to the point or place of BEGINNING.

Containing an area of 15,941.13 square feet or 0.366 acres more or less.

## APPENDIX B

### SITE CONTACTS

| Name                                                                 | Phone/Email Address                                                      |
|----------------------------------------------------------------------|--------------------------------------------------------------------------|
| Site Owner/Remedial Party - LPC Development Group LLC, Peter Procida | 718-299-7000x211 pprocida@procidacompanies.com                           |
| QEP Robert Jackson, P.E.                                             | 973-527-7451<br>bob.jackson@equityenvironmental.com                      |
| NYSDEC Project Manager – Melissa Sweet                               | (518) 402-9614<br>melissa.sweet@dec.ny.gov                               |
| NYSDEC Regional HW Engineer – Jane O’Connell                         | Jane O’Connell 718-482-4995<br><u>jane.oconnell@dec.ny.gov</u> ;         |
| NYSDEC Site Control – Kelly Lewandowski                              | Kelly Lewandowski (518)402-9553<br><u>Kelly.lewandowski@dec.ny.gov</u> , |
| Dean S. Sommer – LPC Development Group Attorney. Young/Summer LLC    | 518.438.9907 Ext. 236<br>DSommer@youngsommer.com                         |

## **APPENDIX C**

### **SOIL BORING LOGS**

| <b>Equity Environmental Engineering</b><br>500 International Drive, Suite 150<br>Mount Olive, New Jersey 07828                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                |                |                                                                                                             |                                                                                                                       |           | CLIENT: LPC Development Group, LLC<br>PROJECT: 105 South 5th Street<br>LOCATION: 105 South 5th St., Brooklyn, NY |                                                                                             |                                                                                                                              |                                                                                     | WELL ID: SB-1                        |                     |                                                                                       |                                                                                      |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|----------------|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|-----------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------|---------------------|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|--|
| START DATE: 10/27/15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                |                                                                                                             |                                                                                                                       |           | DRILLING CO.: Zebra                                                                                              |                                                                                             |                                                                                                                              |                                                                                     | TOTAL DEPTH: 30.0'                   |                     |                                                                                       |                                                                                      |  |
| COMPLETION DATE: 10/27/2015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                |                |                                                                                                             |                                                                                                                       |           | DRILLER: Evan Moraitu                                                                                            |                                                                                             |                                                                                                                              |                                                                                     | WELL DEPTH: N/A                      |                     |                                                                                       |                                                                                      |  |
| BORING DIAMETER: 2.5"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                |                |                                                                                                             |                                                                                                                       |           | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT                                                                |                                                                                             |                                                                                                                              |                                                                                     | CASING ELEVATION: N/A                |                     |                                                                                       |                                                                                      |  |
| WELL DIAMETER: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                |                                                                                                             |                                                                                                                       |           | LOGGED BY: Faron Moser                                                                                           |                                                                                             |                                                                                                                              |                                                                                     | DEPTH TO WATER: No GW in Soil Boring |                     |                                                                                       |                                                                                      |  |
| SCREENED INTERVAL: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                |                                                                                                             |                                                                                                                       |           | WELL TYPE: N/A                                                                                                   |                                                                                             |                                                                                                                              |                                                                                     | WATER LEVEL STATIC: N/A              |                     |                                                                                       |                                                                                      |  |
| SCREEN TYPE / SLOT: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                |                |                                                                                                             |                                                                                                                       |           | FILTER PACK: N/A                                                                                                 |                                                                                             |                                                                                                                              |                                                                                     | CASING TYPE: N/A                     |                     |                                                                                       |                                                                                      |  |
| Depth (Ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Sample ID       | Recovery (in.) | Interval (Ft.) | PID (ppm)                                                                                                   | Reading At                                                                                                            | Sample    | H2O                                                                                                              | Lithology / Remarks                                                                         |                                                                                                                              |                                                                                     |                                      | Boring Construction |                                                                                       |                                                                                      |  |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SB-1<br>(0'-2') | 44"            |                | 0.0                                                                                                         |                                                                                                                       | X         |                                                                                                                  | 0.0'- 1.0'                                                                                  | Concrete Slab- Drill rig pushed through the concrete slab in garage to get to soil material.                                 |                                                                                     |                                      |                     | 0                                                                                     |   |  |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                |                | 0.0                                                                                                         |                                                                                                                       | 1.0'-3.0' |                                                                                                                  | Fill Material. Loose, coarse sand with concrete, brick fragments, medium-large gravel, dry. |                                                                                                                              |                                                                                     |                                      | 1                   |                                                                                       |                                                                                      |  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.0             |                |                | 3.0'-5.0'                                                                                                   | (SW-SM) Well graded sand with silt. Medium dense, Strong Brown (7.5YR 4/6), coarse sand with silt, small gravel, dry. | X         |                                                                                                                  |                                                                                             | 3                                                                                                                            |  |                                      |                     |                                                                                       |                                                                                      |  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.0             |                |                |                                                                                                             |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SB-1<br>(2'-4') | 0.0            | 35"            | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  | 5.0'-6.0'                                                                                   | (SW-SM) Well graded sand with silt. Dense, Strong Brown (7.5YR 4/6), coarse sand with silt, small-medium gravel, dry.        |                                                                                     |                                      |                     | 4                                                                                     |   |  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.0             | 6.0'-6.5'      |                | Red Brick & Large Rock                                                                                      |                                                                                                                       |           |                                                                                                                  | 5                                                                                           |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.0             | 6.5'-7.0'      |                | Rock                                                                                                        |                                                                                                                       |           |                                                                                                                  | 6                                                                                           |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0.0             | 7.0'-10.0'     |                | (SW-SM) Well graded sand with silt. Loose, Light Brown (7.5YR 6/3), fine sand with silt, small gravel, dry. |                                                                                                                       |           |                                                                                                                  | 7                                                                                           |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  | 10.0'-15.0'                                                                                 | (SW-SM) Well graded sand with silt. Dense, Brownish Yellow (10YR 6/8), coarse sand with silt, stiff, medium plasticity, dry. |                                                                                     |                                      |                     | 8                                                                                     |   |  |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | 55"            |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  | 15.0'-20.0'                                                                                 | (SW-SM) Well graded sand with silt. Dense, Brownish Yellow (10YR 6/8), coarse sand with silt, stiff, medium plasticity, dry. |                                                                                     |                                      |                     | 12                                                                                    |  |  |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | 55"            |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      | 16                  |  |                                                                                      |  |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                |                | 0.0                                                                                                         |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     | 20                                                                                    |                                                                                      |  |
| SB-1 Continued on Page 2 of 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |                |                                                                                                             |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| <b>KEY:</b><br>SPT = Standard Penetration Test      SS = Split Spoon      BH = Bore Hole      HS = Headspace      TOSC = Top of Screen<br>CAL = Calibration      A = Auger Cuttings      GS = Grab Sample      Y = Water Level      TOS = Top of Sand      CB = Curb Box<br>BZ = Breathing Zone      GP = Geoprobe      C = Composite      TOB = Top of Bentonite                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                |                |                                                                                                             |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
|  Concrete  SW<br> Fill  SM<br> Brick/Rock  SP<br> Rock  SW-SM |                 |                |                |                                                                                                             |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |
| Page 1 of 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                |                |                                                                                                             |                                                                                                                       |           |                                                                                                                  |                                                                                             |                                                                                                                              |                                                                                     |                                      |                     |                                                                                       |                                                                                      |  |

| Equity Environmental Engineering   |           |                |                |           |            |        | CLIENT: LPC Development Group, LLC                |                                                                                                                                                           | WELL ID: SB-1 (Continued)            |  |
|------------------------------------|-----------|----------------|----------------|-----------|------------|--------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--|
| 500 International Drive, Suite 150 |           |                |                |           |            |        | PROJECT: 105 South 5th Street                     |                                                                                                                                                           |                                      |  |
| Mount Olive, New Jersey 07828      |           |                |                |           |            |        | LOCATION: 105 South 5th St., Brooklyn, NY         |                                                                                                                                                           |                                      |  |
| START DATE: 10/27/15               |           |                |                |           |            |        | DRILLING CO.: Zebra                               |                                                                                                                                                           | TOTAL DEPTH: 30.0'                   |  |
| COMPLETION DATE: 10/27/2015        |           |                |                |           |            |        | DRILLER: Evan Moraitu                             |                                                                                                                                                           | WELL DEPTH: N/A                      |  |
| BORING DIAMETER: 2.5"              |           |                |                |           |            |        | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT |                                                                                                                                                           | CASING ELEVATION: N/A                |  |
| WELL DIAMETER: N/A                 |           |                |                |           |            |        | LOGGED BY: Faron Moser                            |                                                                                                                                                           | DEPTH TO WATER: No GW in Soil Boring |  |
| SCREENED INTERVAL: N/A             |           |                |                |           |            |        | WELL TYPE: N/A                                    |                                                                                                                                                           | WATER LEVEL STATIC: N/A              |  |
| SCREEN TYPE / SLOT: N/A            |           |                |                |           |            |        | FILTER PACK: N/A                                  |                                                                                                                                                           | CASING TYPE: N/A                     |  |
| Depth (Ft.)                        | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample | H2O                                               | Lithology / Remarks                                                                                                                                       | Boring Construction                  |  |
| 20                                 |           |                |                | 0.0       |            |        |                                                   | 20.0'-22.0' (SW-SM) Well graded sand with silt. Dense, Brownish Yellow (10YR 6/8), coarse sand with silt and large gravel, stiff, medium plasticity, dry. | 20                                   |  |
| 21                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 21                                   |  |
| 22                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 22                                   |  |
| 23                                 |           | 37"            |                | 0.0       |            |        |                                                   | 22.0'-25.0' (SW) Well graded sand . Loose, Light Brown (7.5YR 6/3) coarse sand and small gravel, non-plastic, dry.                                        | 23                                   |  |
| 24                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 24                                   |  |
| 25                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 25                                   |  |
| 26                                 |           |                |                | 0.0       |            |        |                                                   | 25.0'-30.0' (SW) Well graded sand. Loose, Light Brown (7.5YR 6/3) coarse sand and small gravel, non-plastic, dry.                                         | 26                                   |  |
| 27                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 27                                   |  |
| 28                                 |           | 58"            |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 28                                   |  |
| 29                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 29                                   |  |
| 30                                 |           |                |                | 0.0       |            |        |                                                   |                                                                                                                                                           | 30                                   |  |
| Boring Stopped at 30.0' bgs        |           |                |                |           |            |        |                                                   |                                                                                                                                                           |                                      |  |

KEY:

SPT = Standard Penetration Test

CAL = Calibration

BZ = Breathing Zone

SS = Split Spoon

A = Auger Cuttings

GP = Geoprobe

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

Y = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Concrete

Fill

Brick/Rock

SW

SM

SP

Rock

SW-SM

Page 2 of 2



| <b>Equity Environmental Engineering</b> |                 |                |                |           |            |        | CLIENT: LPC Development Group, LLC                |                                                                                                                   |                                                                                                                                | WELL ID: SB-2                        |  |  |  |
|-----------------------------------------|-----------------|----------------|----------------|-----------|------------|--------|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--|--|--|
| 500 International Drive, Suite 150      |                 |                |                |           |            |        | PROJECT: 105 South 5th Street                     |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| Mount Olive, New Jersey 07828           |                 |                |                |           |            |        | LOCATION: 105 South 5th St., Brooklyn, NY         |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| START DATE: 10/27/2015                  |                 |                |                |           |            |        | DRILLING CO.: Zebra                               |                                                                                                                   |                                                                                                                                | TOTAL DEPTH: 15.0'                   |  |  |  |
| COMPLETION DATE: 10/27/2015             |                 |                |                |           |            |        | DRILLER: Evan Moraitu                             |                                                                                                                   |                                                                                                                                | WELL DEPTH: N/A                      |  |  |  |
| BORING DIAMETER: 2.5"                   |                 |                |                |           |            |        | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT |                                                                                                                   |                                                                                                                                | CASING ELEVATION: N/A                |  |  |  |
| WELL DIAMETER: N/A                      |                 |                |                |           |            |        | LOGGED BY: Faron Moser                            |                                                                                                                   |                                                                                                                                | DEPTH TO WATER: No GW in Soil Boring |  |  |  |
| SCREENED INTERVAL: N/A                  |                 |                |                |           |            |        | WELL TYPE: N/A                                    |                                                                                                                   |                                                                                                                                | WATER LEVEL STATIC: N/A              |  |  |  |
| SCREEN TYPE / SLOT: N/A                 |                 |                |                |           |            |        | FILTER PACK: N/A                                  |                                                                                                                   |                                                                                                                                | CASING TYPE: N/A                     |  |  |  |
| Depth (Ft.)                             | Sample ID       | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample | H2O                                               | Lithology / Remarks                                                                                               | Boring Construction                                                                                                            |                                      |  |  |  |
| 0                                       | SB-2<br>(0'-2') | 35"            |                | 0.0       |            | X      |                                                   | 0.0' - 0.5'                                                                                                       | Concrete- Drill rig through the concrete floor in the garage area.                                                             | 0                                    |  |  |  |
| 1                                       |                 |                |                | 0.0       |            |        | 0.5' - 2.5'                                       | 1                                                                                                                 |                                                                                                                                |                                      |  |  |  |
| 2                                       |                 |                |                | 0.0       |            |        | 2.5' - 5.0'                                       | 2                                                                                                                 |                                                                                                                                |                                      |  |  |  |
| 3                                       | SB-2<br>(2'-4') | 35"            |                | 0.0       |            | X      |                                                   | (SW-SM) Well graded sand with silt. Medium dense, Yellowish Red (5YR 4/6), fine sand with silt, non-plastic, dry. |                                                                                                                                | 3                                    |  |  |  |
| 4                                       |                 |                |                | 0.0       |            |        | 3                                                 |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 5                                       |                 |                |                | 0.0       |            |        | 4                                                 |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 6                                       |                 | 41"            |                | 0.0       |            |        |                                                   | 5.0' - 10.0'                                                                                                      | (SW-SM) Well graded sand with silt. Very dense, Yellowish Red (5YR 4/6), fine sand with silt, very stiff, low plasticity, dry. | 5                                    |  |  |  |
| 7                                       |                 |                |                | 0.0       |            |        | 5                                                 |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 8                                       |                 |                |                | 0.0       |            |        | 6                                                 |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 9                                       |                 |                |                | 0.0       |            |        | 7                                                 |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 10                                      |                 |                |                | 0.0       |            |        | 8                                                 |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 11                                      |                 | 42"            |                | 0.0       |            |        |                                                   | 10.0' - 15.0'                                                                                                     | (SW-SM) Well graded sand with silt. Very dense, Yellowish Red (5YR 4/6), fine sand with silt, very stiff, low plasticity, dry. | 10                                   |  |  |  |
| 12                                      |                 |                |                | 0.0       |            |        | 10                                                |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 13                                      |                 |                |                | 0.0       |            |        | 11                                                |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 14                                      |                 |                |                | 0.0       |            |        | 12                                                |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| 15                                      |                 |                |                | 0.0       |            |        | 13                                                |                                                                                                                   |                                                                                                                                |                                      |  |  |  |
| Boring Stopped at 15.0' bgs             |                 |                |                |           |            |        |                                                   |                                                                                                                   |                                                                                                                                |                                      |  |  |  |

**KEY:**

SPT = Standard Penetration Test  
CAL = Calibration  
BZ = Breathing Zone

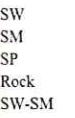
SS = Split Spoon  
A = Auger Cuttings  
GP = Geoprobe

BH = Bore Hole  
GS = Grab Sample  
C = Composite

HS = Headspace  
Y = Water Level  
TOB = Top of Bentonite

TOSC = Top of Screen  
TOS = Top of Sand  
CB = Curb Box

 Concrete  
 Fill  
 Brick/Rock

 SW  
 SM  
 SP  
 Rock  
 SW-SM

Page 1 of 1



| Equity Environmental Engineering   |                 |                |                |           |            |            | CLIENT: LPC Development Group, LLC                                                                                |                     | WELL ID: SB-3                                                                                                                                                                                                              |    |  |
|------------------------------------|-----------------|----------------|----------------|-----------|------------|------------|-------------------------------------------------------------------------------------------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--|
| 500 International Drive, Suite 150 |                 |                |                |           |            |            | PROJECT: 105 South 5th Street                                                                                     |                     |                                                                                                                                                                                                                            |    |  |
| Mount Olive, New Jersey 07828      |                 |                |                |           |            |            | LOCATION: 105 South 5th St., Brooklyn, NY                                                                         |                     |                                                                                                                                                                                                                            |    |  |
| START DATE: 10/27/15               |                 |                |                |           |            |            | DRILLING CO.: Zebra                                                                                               |                     | TOTAL DEPTH: 15.0'                                                                                                                                                                                                         |    |  |
| COMPLETION DATE: 10/27/2015        |                 |                |                |           |            |            | DRILLER: Evan Moraitu                                                                                             |                     | WELL DEPTH: N/A                                                                                                                                                                                                            |    |  |
| BORING DIAMETER: 2.5"              |                 |                |                |           |            |            | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT                                                                 |                     | CASING ELEVATION: N/A                                                                                                                                                                                                      |    |  |
| WELL DIAMETER: N/A                 |                 |                |                |           |            |            | LOGGED BY: Faron Moser                                                                                            |                     | DEPTH TO WATER: No GW in Soil Boring                                                                                                                                                                                       |    |  |
| SCREENED INTERVAL: N/A             |                 |                |                |           |            |            | WELL TYPE: N/A                                                                                                    |                     | WATER LEVEL STATIC: N/A                                                                                                                                                                                                    |    |  |
| SCREEN TYPE / SLOT: N/A            |                 |                |                |           |            |            | FILTER PACK: N/A                                                                                                  |                     | CASING TYPE: N/A                                                                                                                                                                                                           |    |  |
| Depth (Ft.)                        | Sample ID       | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample     | H2O                                                                                                               | Lithology / Remarks | Boring Construction                                                                                                                                                                                                        |    |  |
| 0                                  | SB-3<br>(0'-2') | 47"            |                | 0.0       |            | X          |                                                                                                                   | 0.0'-1.0'           | Fill Material. Loose, coarse sand with asphalt, concrete and gravel mix, dry.<br><br>(SW-SM) Well graded sand with silt. Medium dense, Yellowish Red (5YR 4/6), fine sand with silt, non-plastic, dry.                     | 0  |  |
| 1                                  |                 |                |                | 0.0       |            |            |                                                                                                                   | 1                   |                                                                                                                                                                                                                            |    |  |
| 2                                  |                 |                |                | 0.0       |            |            |                                                                                                                   | 2                   |                                                                                                                                                                                                                            |    |  |
| 3                                  |                 |                |                | 0.0       |            |            |                                                                                                                   | 3                   |                                                                                                                                                                                                                            |    |  |
| 4                                  |                 |                |                | 0.0       |            |            |                                                                                                                   | 4                   |                                                                                                                                                                                                                            |    |  |
| 5                                  | 42"             | 0.0            |                |           |            | 5.0'-10.0' | (SW-SM) Well graded sand with silt. Medium dense, Yellowish Red (5YR 4/6), fine sand with silt, non-plastic, dry. | 5                   |                                                                                                                                                                                                                            |    |  |
| 6                                  |                 | 0.0            |                |           |            | 6          |                                                                                                                   |                     |                                                                                                                                                                                                                            |    |  |
| 7                                  |                 | 0.0            |                |           |            | 7          |                                                                                                                   |                     |                                                                                                                                                                                                                            |    |  |
| 8                                  |                 | 0.0            |                |           |            | 8          |                                                                                                                   |                     |                                                                                                                                                                                                                            |    |  |
| 9                                  |                 | 0.0            |                |           |            | 9          |                                                                                                                   |                     |                                                                                                                                                                                                                            |    |  |
| 10                                 | 54"             | 54"            |                | 0.0       |            | X          |                                                                                                                   | 10.0'-11.0'         | (SW-SM) Well graded sand with silt. Medium dense, Yellowish Red (5YR 4/6), fine sand with silt, non-plastic, dry.<br>Rock<br>(SW-SM) Well graded sand. Medium dense, Yellowish Red (5YR 4/6), fine sand, non-plastic, dry. | 10 |  |
| 11                                 |                 |                |                | 0.0       |            |            |                                                                                                                   | 11                  |                                                                                                                                                                                                                            |    |  |
| 12                                 |                 |                |                | 0.0       |            |            |                                                                                                                   | 12                  |                                                                                                                                                                                                                            |    |  |
| 13                                 |                 |                |                | 0.0       |            |            |                                                                                                                   | 13                  |                                                                                                                                                                                                                            |    |  |
| 14                                 |                 |                |                | 0.0       |            |            |                                                                                                                   | 14                  |                                                                                                                                                                                                                            |    |  |
| 15                                 |                 |                |                | 0.0       |            |            |                                                                                                                   |                     | 15                                                                                                                                                                                                                         |    |  |

**KEY:**  
 SPT = Standard Penetration Test  
 CAL = Calibration  
 BZ = Breathing Zone

SS = Split Spoon  
 A = Auger Cuttings  
 GP = Geoprobe

BH = Bore Hole  
 GS = Grab Sample  
 C = Composite

HS = Headspace  
 Y = Water Level  
 TOB = Top of Bentonite

TOSC = Top of Screen  
 TOS = Top of Sand  
 CB = Curb Box

Concrete  
  
Fill  
  
Brick/Rock

SW  
  
SM  
  
SP  
  
Rock  
  
SW-SM

|                                    |                 |                |                |           |            |        |                                                   |                     |                                                                                                                                     |           |                                                                                         |                     |                             |  |  |  |  |  |
|------------------------------------|-----------------|----------------|----------------|-----------|------------|--------|---------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------------------------------------------------------------------------|---------------------|-----------------------------|--|--|--|--|--|
| Equity Environmental Engineering   |                 |                |                |           |            |        | CLIENT: LPC Development Group, LLC                |                     |                                                                                                                                     |           | WELL ID: SB-4                                                                           |                     |                             |  |  |  |  |  |
| 500 International Drive, Suite 150 |                 |                |                |           |            |        | PROJECT: 105 South 5th Street                     |                     |                                                                                                                                     |           |                                                                                         |                     |                             |  |  |  |  |  |
| Mount Olive, New Jersey 07828      |                 |                |                |           |            |        | LOCATION: 105 South 5th St., Brooklyn, NY         |                     |                                                                                                                                     |           |                                                                                         |                     |                             |  |  |  |  |  |
| START DATE: 10/26/2015             |                 |                |                |           |            |        | DRILLING CO.: Zebra                               |                     |                                                                                                                                     |           | TOTAL DEPTH: 20.0'                                                                      |                     |                             |  |  |  |  |  |
| COMPLETION DATE: 10/26/2015        |                 |                |                |           |            |        | DRILLER: Evan Moraitu                             |                     |                                                                                                                                     |           | WELL DEPTH: N/A                                                                         |                     |                             |  |  |  |  |  |
| BORING DIAMETER: 2.5"              |                 |                |                |           |            |        | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT |                     |                                                                                                                                     |           | CASING ELEVATION: N/A                                                                   |                     |                             |  |  |  |  |  |
| WELL DIAMETER: N/A                 |                 |                |                |           |            |        | LOGGED BY: Faron Moser                            |                     |                                                                                                                                     |           | DEPTH TO WATER: No GW in Soil Boring                                                    |                     |                             |  |  |  |  |  |
| SCREENED INTERVAL: N/A             |                 |                |                |           |            |        | WELL TYPE: N/A                                    |                     |                                                                                                                                     |           | WATER LEVEL STATIC: N/A                                                                 |                     |                             |  |  |  |  |  |
| SCREEN TYPE / SLOT: N/A            |                 |                |                |           |            |        | FILTER PACK: N/A                                  |                     |                                                                                                                                     |           | CASING TYPE: N/A                                                                        |                     |                             |  |  |  |  |  |
| Depth (Ft.)                        | Sample ID       | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample | H2O                                               | Lithology / Remarks |                                                                                                                                     |           |                                                                                         | Boring Construction |                             |  |  |  |  |  |
| 0                                  | SB-4<br>(0'-2') | 48"            |                | 0.0       |            | X      |                                                   | 0.0'-2.0'           | Fill Material- Loose, coarse sand with concrete, brick fragments, med-large gravel, dry                                             |           |                                                                                         |                     | 0                           |  |  |  |  |  |
| 1                                  |                 |                |                | 0.0       |            |        |                                                   | 2.0'-5.0'           | (SW-SM) Well graded sand with silt. Dense, Yellowish-red (5YR 4/6), fine sand with silt, dry.                                       | 1         |                                                                                         |                     |                             |  |  |  |  |  |
| 2                                  |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     | 2         |                                                                                         |                     |                             |  |  |  |  |  |
| 3                                  |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     | 3         |                                                                                         |                     |                             |  |  |  |  |  |
| 4                                  |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     | 4         |                                                                                         |                     |                             |  |  |  |  |  |
| 5                                  |                 |                |                | 0.0       |            |        |                                                   | 5.0'-6.0'           | (SW) Well graded sand. Medium dense, Strong Brown (7.5YR 5/8), coarse sand with small - medium gravel, dry.                         |           |                                                                                         |                     | 5                           |  |  |  |  |  |
| 6                                  |                 |                |                | 0.4       |            |        |                                                   | 6.0'-10.0'          | (SW) Well graded sand. Dense, Strong Brown (7.5YR 5/8), fine sand with small gravel, dry. Note: White rock observed @ 6.0' to 6.25' | 6         |                                                                                         |                     |                             |  |  |  |  |  |
| 7                                  |                 |                |                | 0.2       |            |        |                                                   |                     |                                                                                                                                     | 7         |                                                                                         |                     |                             |  |  |  |  |  |
| 8                                  |                 |                |                | 0.2       |            |        |                                                   |                     |                                                                                                                                     | 8         |                                                                                         |                     |                             |  |  |  |  |  |
| 9                                  |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     | 9         |                                                                                         |                     |                             |  |  |  |  |  |
| 10                                 |                 |                |                | 0.0       |            |        |                                                   | 10.0'-12.0'         | (SW) Well graded sand. Yellowish-red (7.5YR 5/8), coarse sand with small gravel, dry.                                               |           |                                                                                         |                     | 10                          |  |  |  |  |  |
| 11                                 |                 |                |                | 0.1       |            |        |                                                   | 12.0'-12.5'         | White Rock                                                                                                                          | 11        |                                                                                         |                     |                             |  |  |  |  |  |
| 12                                 |                 |                |                | 0.1       |            |        |                                                   |                     |                                                                                                                                     | 12.5'-15' | (SW-SM) Well graded sand and silt. Medium dense, fine sand with silt, non-plastic, dry. | 12                  |                             |  |  |  |  |  |
| 13                                 |                 |                |                | 0.1       |            |        |                                                   |                     |                                                                                                                                     |           |                                                                                         | 13                  |                             |  |  |  |  |  |
| 14                                 |                 |                |                | 0.1       |            |        |                                                   |                     |                                                                                                                                     | 14        |                                                                                         |                     |                             |  |  |  |  |  |
| 15                                 |                 |                |                | 0.1       |            |        |                                                   | 15.0'-17.5'         | (SW-SM) Well graded sand and silt. Medium dense, fine sand with silt, non-plastic, dry.                                             |           |                                                                                         |                     | 15                          |  |  |  |  |  |
| 16                                 |                 |                |                | 0.0       |            |        |                                                   | 17.5'-18'           | White Rock                                                                                                                          | 16        |                                                                                         |                     |                             |  |  |  |  |  |
| 17                                 |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     | 18'-19.5' | (SW) Well graded sand. Yellowish-red (7.5YR 5/8), coarse sand with small gravel, dry.   | 17                  |                             |  |  |  |  |  |
| 18                                 |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     |           |                                                                                         | 18                  |                             |  |  |  |  |  |
| 19                                 |                 |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                     | 19        |                                                                                         |                     |                             |  |  |  |  |  |
| 20                                 |                 |                |                | 0.0       |            |        |                                                   | 19.5'-20.0'         | Rock                                                                                                                                |           |                                                                                         |                     | 20                          |  |  |  |  |  |
|                                    |                 |                |                |           |            |        |                                                   |                     |                                                                                                                                     |           |                                                                                         |                     | Boring Refusal at 20.0' bgs |  |  |  |  |  |

KEY:

SPT = Standard Penetration Test

CAL = Calibration

BZ = Breathing Zone

SS = Split Spoon

A = Auger Cuttings

GP = Geoprobe

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

Y = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Concrete

Fill

Brick/Rock

SW

SM

SP

Rock

SW-SM

|                                    |                   |                |                |           |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     |    |  |  |  |  |  |
|------------------------------------|-------------------|----------------|----------------|-----------|------------|--------|---------------------------------------------------|---------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--------------------------------------|---------------------|----|--|--|--|--|--|
| Equity Environmental Engineering   |                   |                |                |           |            |        | CLIENT: LPC Development Group, LLC                |                     |                                                                                                                                                   |  |  |  |  | WELL ID: SB-5                        |                     |    |  |  |  |  |  |
| 500 International Drive, Suite 150 |                   |                |                |           |            |        | PROJECT: 105 South 5th Street                     |                     |                                                                                                                                                   |  |  |  |  |                                      |                     |    |  |  |  |  |  |
| Mount Olive, New Jersey 07828      |                   |                |                |           |            |        | LOCATION: 105 South 5th St., Brooklyn, NY         |                     |                                                                                                                                                   |  |  |  |  |                                      |                     |    |  |  |  |  |  |
| START DATE: 10/26/2015             |                   |                |                |           |            |        | DRILLING CO.: Zebra                               |                     |                                                                                                                                                   |  |  |  |  | TOTAL DEPTH: 23.0'                   |                     |    |  |  |  |  |  |
| COMPLETION DATE: 10/26/2015        |                   |                |                |           |            |        | DRILLER: Evan Moraitu                             |                     |                                                                                                                                                   |  |  |  |  | WELL DEPTH: N/A                      |                     |    |  |  |  |  |  |
| BORING DIAMETER: 2.5"              |                   |                |                |           |            |        | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT |                     |                                                                                                                                                   |  |  |  |  | CASING ELEVATION: N/A                |                     |    |  |  |  |  |  |
| WELL DIAMETER: N/A                 |                   |                |                |           |            |        | LOGGED BY: Faron Moser                            |                     |                                                                                                                                                   |  |  |  |  | DEPTH TO WATER: No GW in Soil Boring |                     |    |  |  |  |  |  |
| SCREENED INTERVAL: N/A             |                   |                |                |           |            |        | WELL TYPE: N/A                                    |                     |                                                                                                                                                   |  |  |  |  | WATER LEVEL STATIC: N/A              |                     |    |  |  |  |  |  |
| SCREEN TYPE / SLOT: N/A            |                   |                |                |           |            |        | FILTER PACK: N/A                                  |                     |                                                                                                                                                   |  |  |  |  | CASING TYPE: N/A                     |                     |    |  |  |  |  |  |
| Depth (Ft.)                        | Sample ID         | Recovery (in.) | Interval (Ft.) | PTD (ppm) | Reading At | Sample | H2O                                               | Lithology / Remarks |                                                                                                                                                   |  |  |  |  |                                      | Boring Construction |    |  |  |  |  |  |
| 0                                  | SB-5<br>(0'-2')   | 53"            |                | 0.0       |            | X      |                                                   | 0.0'-1.0'           | Fill Material- Very loose, Dark Yellowish Brown (10YR 4/6 ) coarse sand with silt, large gravel, dry                                              |  |  |  |  |                                      |                     | 0  |  |  |  |  |  |
| 1                                  |                   |                |                | 0.0       |            |        |                                                   | 1.0'-5.0'           | (SW-SM) Well graded sand with silt. Medium dense, Strong Brown (7.5YR 4/6), coarse sand with silt, small gravel, dry. Note: Concrete chunk @ 3.5" |  |  |  |  |                                      |                     | 1  |  |  |  |  |  |
| 2                                  |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 2  |  |  |  |  |  |
| 3                                  |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 3  |  |  |  |  |  |
| 4                                  |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 4  |  |  |  |  |  |
| 5                                  |                   | 56"            |                | 0.0       |            |        |                                                   | 5.0'-7.0'           | (SW-SM) Well graded sand with silt. Medium dense, Strong Brown (7.5YR 4/6), coarse sand with silt, small gravel, dry.                             |  |  |  |  |                                      |                     | 5  |  |  |  |  |  |
| 6                                  |                   |                |                | 0.0       |            |        |                                                   | 7.0'-7.5'           | Concrete, dry                                                                                                                                     |  |  |  |  |                                      |                     | 6  |  |  |  |  |  |
| 7                                  |                   |                |                | 0.0       |            |        |                                                   | 7.5'-8.0'           | See (5.0'-7.0')                                                                                                                                   |  |  |  |  |                                      |                     | 7  |  |  |  |  |  |
| 8                                  |                   |                |                | 0.0       |            |        |                                                   | 8.0'-10.0'          | (SW) Well graded sand. Loose, Yellowish-red(5YR 4/6) fine sand with no gravel, dry.                                                               |  |  |  |  |                                      |                     | 8  |  |  |  |  |  |
| 9                                  |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 9  |  |  |  |  |  |
| 10                                 | SB-5<br>(12'-14') | 56"            |                | 0.0       |            | X      |                                                   | 10.0'-13.0'         | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6) fine sand with no gravel, dry.                                                              |  |  |  |  |                                      |                     | 10 |  |  |  |  |  |
| 11                                 |                   |                |                | 0.0       |            |        |                                                   | 13.0'-15.0'         | (SW-SM) Well graded sand with silt. Medium dense, Brownish-yellow (10YR 4/6 ) , coarse sand with silt, small gravel, non-plastic, dry.            |  |  |  |  |                                      |                     | 11 |  |  |  |  |  |
| 12                                 |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 12 |  |  |  |  |  |
| 13                                 |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 13 |  |  |  |  |  |
| 14                                 |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 14 |  |  |  |  |  |
| 15                                 |                   | 56"            |                | 0.0       |            |        |                                                   | 15.0'-15.5'         | See (8.0'-10.0')                                                                                                                                  |  |  |  |  |                                      |                     | 15 |  |  |  |  |  |
| 16                                 |                   |                |                | 0.0       |            |        |                                                   | 15.5'-18.5'         | (SW-SM) Well graded sand with silt. Dense, Dark Yellowish-brown (10YR 4/6 ), coarse sand with silt, small gravel, dry.                            |  |  |  |  |                                      |                     | 16 |  |  |  |  |  |
| 17                                 |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 17 |  |  |  |  |  |
| 18                                 |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 18 |  |  |  |  |  |
| 19                                 |                   |                |                | 0.0       |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     | 19 |  |  |  |  |  |
| 20                                 |                   |                |                | 0.0       |            |        |                                                   | 18.5'-20            | (SW-SM) Well graded sand with silt. Dense, Yellowish-brown (10YR 4/6 ), coarse sand, silt, small gravel, dry. Note: White rock @ 18.5'-19.5'      |  |  |  |  |                                      |                     | 20 |  |  |  |  |  |
| SB-5 Continued on Page 2 of 2      |                   |                |                |           |            |        |                                                   |                     |                                                                                                                                                   |  |  |  |  |                                      |                     |    |  |  |  |  |  |

KEY:

SPT = Standard Penetration Test

SS = Split Spoon

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

V = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Grout

Concrete

Fill

Brick/Rock

SW

SM

SP

Rock

SW-SM

Page 1 of 2



[illegible]

| Equity Environmental Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                   |                |                |           |                    |        | CLIENT: LPC Development Group, LLC                |                                                                                                                                                      |                                                                                                             |                  | WELL ID: SB-6                        |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------|----------------|-----------|--------------------|--------|---------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------|--|--|--|------------------------|-----------|----------------|----------------|-----------|----------------------|--------|-----|---------------------|---------------------|-----------|--|--|--|--|---------------------------------|-----------------|-----|--|-----|------------------|---|--|-----------|-------------------------------------------------------------------------------------------|----------------|--|--|--|--|----------------|-----|-----------|---|---|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|-----|-------------------|---|-----|---|---|--------------------|-----|--|-----|--|------------------|--|------------|---------------------------------------------------------------------------------------------------------|---|-----------------|--|--|--|---|-------------------|---|---|-----|---|---------------------|-----|---|---|-----|---------------|----|-------------------|-----|--|---------------|--|---|--|-------------|---------------------------------------------------------------------------------------------------------|----|--|--|--|---------------|----|-----|----|----|-----|----|----|-----|----|----|-----|----|----|--|-----|--|-----|--|--|--|-------------|-------------------------------------------------------------------------------------|----|--|--|--|--|----|-----|----|----|-----|-------------|-------------------------------------------------------------------------------------------------------------|----|----|-----|----|----|-----|----|----|--|--|--|-----|--|--|--|-------------|------|----|--|--|--|--|-----------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| 500 International Drive, Suite 150                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                |           |                    |        | PROJECT: 105 South 5th Street                     |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mount Olive, New Jersey 07828                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                |           |                    |        | LOCATION: 105 South 5th St., Brooklyn, NY         |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| START DATE: 10/26/2015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                |                |           |                    |        | DRILLING CO.: Zebra                               |                                                                                                                                                      |                                                                                                             |                  | TOTAL DEPTH: 20.0'                   |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| COMPLETION DATE: 10/26/2015                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                |                |           |                    |        | DRILLER: Evan Moraitu                             |                                                                                                                                                      |                                                                                                             |                  | WELL DEPTH: N/A                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BORING DIAMETER: 2.5"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |                |                |           |                    |        | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT |                                                                                                                                                      |                                                                                                             |                  | CASING ELEVATION: N/A                |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| WELL DIAMETER: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                |           |                    |        | LOGGED BY: Faron Moser                            |                                                                                                                                                      |                                                                                                             |                  | DEPTH TO WATER: No GW in Soil Boring |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SCREENED INTERVAL: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                |                |           |                    |        | WELL TYPE: N/A                                    |                                                                                                                                                      |                                                                                                             |                  | WATER LEVEL STATIC: N/A              |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SCREEN TYPE / SLOT: N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |                |                |           |                    |        | FILTER PACK: N/A                                  |                                                                                                                                                      |                                                                                                             |                  | CASING TYPE: N/A                     |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <table><tr><th>Depth (Ft.)</th><th>Sample ID</th><th>Recovery (in.)</th><th>Interval (Ft.)</th><th>PTD (ppm)</th><th>Reading At</th><th>Sample</th><th>H2O</th><th>Lithology / Remarks</th><th colspan="6">Boring Construction</th></tr><tr><td>0</td><td rowspan="5">SB-6<br/>(0'-2')</td><td rowspan="5">51"</td><td rowspan="5"></td><td>0.0</td><td rowspan="5"></td><td rowspan="5">X</td><td rowspan="5"></td><td>0.0'-1.0'</td><td rowspan="5">Fill Material- Loose, Dark Brown (7.5YR 3/3 ) coarse sand with small-medium gravel, dr y.</td><td>0</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td></tr><tr><td>1</td><td>0.0</td><td>1.0'-5.0'</td><td>1</td></tr><tr><td>2</td><td>0.0</td><td rowspan="3">(SW-SM) Well graded sand with silt. Dense, Yellowish-red (5YR 4/6), fine sand with silt, small gravel, dry. Note: Rock @ 4.5' bgs Geoprobe hit Rock.</td><td>2</td></tr><tr><td>3</td><td>0.0</td><td>3</td></tr><tr><td>4</td><td>0.0</td><td>4</td></tr><tr><td>5</td><td rowspan="5"></td><td rowspan="5">55"</td><td rowspan="5"></td><td>0.0</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td>5.0'-10.0'</td><td rowspan="5">(SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, no gravel, no silt, non-plastic, dry.</td><td>5</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td></tr><tr><td>6</td><td>0.0</td><td>6</td></tr><tr><td>7</td><td>0.0</td><td>7</td></tr><tr><td>8</td><td>0.0</td><td>8</td></tr><tr><td>9</td><td>0.0</td><td>9</td></tr><tr><td>10</td><td rowspan="5">SB-6<br/>(12'-14')</td><td rowspan="5">56"</td><td rowspan="5"></td><td>0.0</td><td rowspan="5"></td><td rowspan="5">X</td><td rowspan="5"></td><td>10.0'-15.0'</td><td rowspan="5">(SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, no gravel, no silt, non-plastic, dry.</td><td>10</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td></tr><tr><td>11</td><td>0.0</td><td>11</td></tr><tr><td>12</td><td>0.0</td><td>12</td></tr><tr><td>13</td><td>0.0</td><td>13</td></tr><tr><td>14</td><td>0.0</td><td>14</td></tr><tr><td>15</td><td rowspan="5"></td><td rowspan="5">55"</td><td rowspan="5"></td><td>0.0</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td>15.0'-17.0'</td><td rowspan="2">(SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, non-plastic, dry.</td><td>15</td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td><td rowspan="5"></td></tr><tr><td>16</td><td>0.0</td><td>16</td></tr><tr><td>17</td><td>0.0</td><td>17.0'-19.5'</td><td rowspan="3">(SW-SM) Well graded sand with silt. Dense, Dark Brown (7.5YR 3/3) coarse sand with silt, large gravel, dry.</td><td>17</td></tr><tr><td>18</td><td>0.0</td><td>18</td></tr><tr><td>19</td><td>0.0</td><td>19</td></tr><tr><td>20</td><td></td><td></td><td></td><td>0.0</td><td></td><td></td><td></td><td>19.5'-20.0'</td><td>Rock</td><td>20</td><td></td><td></td><td></td><td></td></tr><tr><td colspan="9">Boring Refusal at 20.0' bgs</td><td colspan="6"></td></tr></table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  | Depth (Ft.)            | Sample ID | Recovery (in.) | Interval (Ft.) | PTD (ppm) | Reading At           | Sample | H2O | Lithology / Remarks | Boring Construction |           |  |  |  |  | 0                               | SB-6<br>(0'-2') | 51" |  | 0.0 |                  | X |  | 0.0'-1.0' | Fill Material- Loose, Dark Brown (7.5YR 3/3 ) coarse sand with small-medium gravel, dr y. | 0              |  |  |  |  | 1              | 0.0 | 1.0'-5.0' | 1 | 2 | 0.0                  | (SW-SM) Well graded sand with silt. Dense, Yellowish-red (5YR 4/6), fine sand with silt, small gravel, dry. Note: Rock @ 4.5' bgs Geoprobe hit Rock. | 2 | 3 | 0.0 | 3                 | 4 | 0.0 | 4 | 5 |                    | 55" |  | 0.0 |  |                  |  | 5.0'-10.0' | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, no gravel, no silt, non-plastic, dry. | 5 |                 |  |  |  | 6 | 0.0               | 6 | 7 | 0.0 | 7 | 8                   | 0.0 | 8 | 9 | 0.0 | 9             | 10 | SB-6<br>(12'-14') | 56" |  | 0.0           |  | X |  | 10.0'-15.0' | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, no gravel, no silt, non-plastic, dry. | 10 |  |  |  |               | 11 | 0.0 | 11 | 12 | 0.0 | 12 | 13 | 0.0 | 13 | 14 | 0.0 | 14 | 15 |  | 55" |  | 0.0 |  |  |  | 15.0'-17.0' | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, non-plastic, dry. | 15 |  |  |  |  | 16 | 0.0 | 16 | 17 | 0.0 | 17.0'-19.5' | (SW-SM) Well graded sand with silt. Dense, Dark Brown (7.5YR 3/3) coarse sand with silt, large gravel, dry. | 17 | 18 | 0.0 | 18 | 19 | 0.0 | 19 | 20 |  |  |  | 0.0 |  |  |  | 19.5'-20.0' | Rock | 20 |  |  |  |  | Boring Refusal at 20.0' bgs |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Depth (Ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Sample ID         | Recovery (in.) | Interval (Ft.) | PTD (ppm) | Reading At         | Sample | H2O                                               | Lithology / Remarks                                                                                                                                  | Boring Construction                                                                                         |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | SB-6<br>(0'-2')   | 51"            |                | 0.0       |                    | X      |                                                   | 0.0'-1.0'                                                                                                                                            | Fill Material- Loose, Dark Brown (7.5YR 3/3 ) coarse sand with small-medium gravel, dr y.                   | 0                |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   | 1.0'-5.0'                                                                                                                                            |                                                                                                             | 1                |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   | (SW-SM) Well graded sand with silt. Dense, Yellowish-red (5YR 4/6), fine sand with silt, small gravel, dry. Note: Rock @ 4.5' bgs Geoprobe hit Rock. |                                                                                                             | 2                |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   |                                                                                                                                                      |                                                                                                             | 3                |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   |                                                                                                                                                      |                                                                                                             | 4                |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   | 55"            |                | 0.0       |                    |        |                                                   | 5.0'-10.0'                                                                                                                                           | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, no gravel, no silt, non-plastic, dry.     | 5                |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   | 6                                                                                                                                                    |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   | 7                                                                                                                                                    |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   | 8                                                                                                                                                    |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                | 0.0       |                    |        |                                                   | 9                                                                                                                                                    |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SB-6<br>(12'-14') | 56"            |                | 0.0       |                    | X      |                                                   | 10.0'-15.0'                                                                                                                                          | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, no gravel, no silt, non-plastic, dry.     | 10               |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 11                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 12                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 13                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 14                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   | 55"            |                | 0.0       |                    |        |                                                   | 15.0'-17.0'                                                                                                                                          | (SW) Well graded sand. Loose, Yellowish-red (5YR 4/6), fine sand, non-plastic, dry.                         | 15               |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 16                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 17.0'-19.5'                                                                                                                                          | (SW-SM) Well graded sand with silt. Dense, Dark Brown (7.5YR 3/3) coarse sand with silt, large gravel, dry. | 17               |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 18                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 19                                                                                                                                                   |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                | 0.0       |                    |        |                                                   | 19.5'-20.0'                                                                                                                                          | Rock                                                                                                        | 20               |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Boring Refusal at 20.0' bgs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <table><tr><td colspan="5"><b>KEY:</b></td><td colspan="5"><b>Concrete</b></td><td colspan="5"><b>SW</b></td></tr><tr><td colspan="5">SPT = Standard Penetration Test</td><td colspan="5">SS = Split Spoon</td><td colspan="5">BH = Bore Hole</td><td colspan="5">HS = Headspace</td><td colspan="5">TOSC = Top of Screen</td></tr><tr><td colspan="5">CAL = Calibration</td><td colspan="5">A = Auger Cuttings</td><td colspan="5">GS = Grab Sample</td><td colspan="5">Y = Water Level</td><td colspan="5">TOS = Top of Sand</td></tr><tr><td colspan="5">BZ = Breathing Zone</td><td colspan="5">GP = Geoprobe</td><td colspan="5">C = Composite</td><td colspan="5">TOB = Top of Bentonite</td><td colspan="5">CB = Curb Box</td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td><td colspan="5"></td></tr><tr><td colspan="5"></td></tr></table> |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  | <b>KEY:</b>            |           |                |                |           | <b>Concrete</b>      |        |     |                     |                     | <b>SW</b> |  |  |  |  | SPT = Standard Penetration Test |                 |     |  |     | SS = Split Spoon |   |  |           |                                                                                           | BH = Bore Hole |  |  |  |  | HS = Headspace |     |           |   |   | TOSC = Top of Screen |                                                                                                                                                      |   |   |     | CAL = Calibration |   |     |   |   | A = Auger Cuttings |     |  |     |  | GS = Grab Sample |  |            |                                                                                                         |   | Y = Water Level |  |  |  |   | TOS = Top of Sand |   |   |     |   | BZ = Breathing Zone |     |   |   |     | GP = Geoprobe |    |                   |     |  | C = Composite |  |   |  |             | TOB = Top of Bentonite                                                                                  |    |  |  |  | CB = Curb Box |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| <b>KEY:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                |                |           | <b>Concrete</b>    |        |                                                   |                                                                                                                                                      |                                                                                                             | <b>SW</b>        |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SPT = Standard Penetration Test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           | SS = Split Spoon   |        |                                                   |                                                                                                                                                      |                                                                                                             | BH = Bore Hole   |                                      |  |  |  | HS = Headspace         |           |                |                |           | TOSC = Top of Screen |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| CAL = Calibration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                |           | A = Auger Cuttings |        |                                                   |                                                                                                                                                      |                                                                                                             | GS = Grab Sample |                                      |  |  |  | Y = Water Level        |           |                |                |           | TOS = Top of Sand    |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BZ = Breathing Zone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |                |                |           | GP = Geoprobe      |        |                                                   |                                                                                                                                                      |                                                                                                             | C = Composite    |                                      |  |  |  | TOB = Top of Bentonite |           |                |                |           | CB = Curb Box        |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   |                |                |           |                    |        |                                                   |                                                                                                                                                      |                                                                                                             |                  |                                      |  |  |  |                        |           |                |                |           |                      |        |     |                     |                     |           |  |  |  |  |                                 |                 |     |  |     |                  |   |  |           |                                                                                           |                |  |  |  |  |                |     |           |   |   |                      |                                                                                                                                                      |   |   |     |                   |   |     |   |   |                    |     |  |     |  |                  |  |            |                                                                                                         |   |                 |  |  |  |   |                   |   |   |     |   |                     |     |   |   |     |               |    |                   |     |  |               |  |   |  |             |                                                                                                         |    |  |  |  |               |    |     |    |    |     |    |    |     |    |    |     |    |    |  |     |  |     |  |  |  |             |                                                                                     |    |  |  |  |  |    |     |    |    |     |             |                                                                                                             |    |    |     |    |    |     |    |    |  |  |  |     |  |  |  |             |      |    |  |  |  |  |                             |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

|                                    |                   |                |                |           |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      |                     |  |  |  |  |  |  |
|------------------------------------|-------------------|----------------|----------------|-----------|------------|--------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--------------------------------------|---------------------|--|--|--|--|--|--|
| Equity Environmental Engineering   |                   |                |                |           |            |        | CLIENT: LPC Development Group, LLC                |                                                                                                                 |  |  |  |  |  | WELL ID: SB-7                        |                     |  |  |  |  |  |  |
| 500 International Drive, Suite 150 |                   |                |                |           |            |        | PROJECT: 105 South 5th Street                     |                                                                                                                 |  |  |  |  |  |                                      |                     |  |  |  |  |  |  |
| Mount Olive, New Jersey 07828      |                   |                |                |           |            |        | LOCATION: 105 South 5th St., Brooklyn, NY         |                                                                                                                 |  |  |  |  |  |                                      |                     |  |  |  |  |  |  |
| START DATE: 10/26/2015             |                   |                |                |           |            |        | DRILLING CO.: Zebra                               |                                                                                                                 |  |  |  |  |  | TOTAL DEPTH: 19.0'                   |                     |  |  |  |  |  |  |
| COMPLETION DATE: 10/26/2015        |                   |                |                |           |            |        | DRILLER: Evan Moraitu                             |                                                                                                                 |  |  |  |  |  | WELL DEPTH: N/A                      |                     |  |  |  |  |  |  |
| BORING DIAMETER: 2.5"              |                   |                |                |           |            |        | DRILL RIG / METHOD: Direct Puch / GeoProbe 7822DT |                                                                                                                 |  |  |  |  |  | CASING ELEVATION: N/A                |                     |  |  |  |  |  |  |
| WELL DIAMETER: N/A                 |                   |                |                |           |            |        | LOGGED BY: Faron Moser                            |                                                                                                                 |  |  |  |  |  | DEPTH TO WATER: No GW in Soil Boring |                     |  |  |  |  |  |  |
| SCREENED INTERVAL: N/A             |                   |                |                |           |            |        | WELL TYPE: N/A                                    |                                                                                                                 |  |  |  |  |  | WATER LEVEL STATIC: N/A              |                     |  |  |  |  |  |  |
| SCREEN TYPE / SLOT: N/A            |                   |                |                |           |            |        | FILTER PACK: N/A                                  |                                                                                                                 |  |  |  |  |  | CASING TYPE: N/A                     |                     |  |  |  |  |  |  |
| Depth (Ft.)                        | Sample ID         | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample | H2O                                               | Lithology / Remarks                                                                                             |  |  |  |  |  |                                      | Boring Construction |  |  |  |  |  |  |
| 0                                  | SB-7<br>(0'-2')   | 32"            |                | 0.0       |            | X      |                                                   | 0.0'-5.0' Fill Material- Loose, Dark Brown (7.5YR 3/2 ) coarse sand with concrete, brick fragments, gravel, dry |  |  |  |  |  |                                      | 0                   |  |  |  |  |  |  |
| 1                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 1                   |  |  |  |  |  |  |
| 2                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 2                   |  |  |  |  |  |  |
| 3                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 3                   |  |  |  |  |  |  |
| 4                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 4                   |  |  |  |  |  |  |
| 5                                  |                   |                |                | 0.0       |            |        |                                                   | 5.0'-10.0' (SW) Well graded sand- Dense, Strong Brown (7.5YR 5/8), fine sand with small-large gravel, dry.      |  |  |  |  |  |                                      | 5                   |  |  |  |  |  |  |
| 6                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 6                   |  |  |  |  |  |  |
| 7                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 7                   |  |  |  |  |  |  |
| 8                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 8                   |  |  |  |  |  |  |
| 9                                  |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 9                   |  |  |  |  |  |  |
| 10                                 | SB-7<br>(12'-14') | 58"            |                | 0.0       |            | X      |                                                   | 10.0'-15.0' (SW) Well graded sand- Dense, Dark yellowish brown (10YR 4/6), fine sand, dry.                      |  |  |  |  |  |                                      | 10                  |  |  |  |  |  |  |
| 11                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 11                  |  |  |  |  |  |  |
| 12                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 12                  |  |  |  |  |  |  |
| 13                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 13                  |  |  |  |  |  |  |
| 14                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 14                  |  |  |  |  |  |  |
| 15                                 |                   |                |                | 0.0       |            |        |                                                   | 15.0'-19.0' (SW) Well graded sand- Dense, Dark yellowish brown (10YR 4/6), fine sand , dry.                     |  |  |  |  |  |                                      | 15                  |  |  |  |  |  |  |
| 16                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 16                  |  |  |  |  |  |  |
| 17                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 17                  |  |  |  |  |  |  |
| 18                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 18                  |  |  |  |  |  |  |
| 19                                 |                   |                |                | 0.0       |            |        |                                                   |                                                                                                                 |  |  |  |  |  |                                      | 19                  |  |  |  |  |  |  |
|                                    |                   |                |                |           |            |        |                                                   | Boring Refusal at 19.0' bgs                                                                                     |  |  |  |  |  |                                      |                     |  |  |  |  |  |  |

KEY:

SPT = Standard Penetration Test

CAL = Calibration

BZ = Breathing Zone

SS = Split Spoon

A = Auger Cuttings

GP = Geoprobe

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

V = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Concrete

Fill

Brick/Rock

SW

SM

SP

Rock

SW-SM

**KEY:**

SPT = Standard Penetration Test  
CAL = Calibration  
BZ = Breathing Zone

SS = Split Spoon  
A = Auger Cuttings  
GP = Geoprobe

BH = Bore Hole  
GS = Grab Sample  
C = Composite

HS = Headspace  
V = Water Level  
TOB = Top of Bentonite

TOSC = Top of Screen  
TOS = Top of Sand  
CB = Curb Box



Concrete  
Fill  
Brick/Rock



SW  
SM  
SP  
Rock  
SW-SM

**APPENDIX D**  
**MONITORING WELL CONSTRUCTION LOGS**

**Equity Environmental Engineering**  
500 International Drive, Suite 150  
Mount Olive, New Jersey 07828

CLIENT:   **LPC Development Group LLC.**  
PROJECT:   **LPC**  
LOCATION:   **95-105 South 5th Street, Brooklyn, NY**

SB/WELL ID:   **MW-1**  
PERMIT #:

START DATE:           **9/13/2018**
DRILLING CO.:           **ADT**
TOTAL DEPTH:           **55'**

COMPLETION DATE:   **9/13/2018**
DRILLER:               **Brian and Patrick**
WELL DEPTH:           **55'**

BORING DIAMETER:   **6"**
DRILL RIG / METHOD:   **Sonic Rig**
CASING ELEVATION:   **N/A**

WELL DIAMETER:       **2"**
LOGGED BY:           **John Vrabel**
DEPTH TO WATER:      **49.0'**

SCREENED INTERVAL:   **45'-55'**
WELL TYPE:           **Flush Monitoring Well**
WATER LEVEL STATIC:   **43.35'**

SCREEN TYPE / SLOT:   **2" diameter PVC/ 010 Slot**
FILTER PACK:           **# 2 Well Grade Sand**
CASING TYPE:           **2" diameter SCH40 PVC**

| Depth (Ft.) | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample Type | H2O | Lithology / Remarks                                                                     | Boring/Well Construction |  |            |  |
|-------------|-----------|----------------|----------------|-----------|------------|-------------|-----|-----------------------------------------------------------------------------------------|--------------------------|--|------------|--|
| 0           |           |                |                |           |            |             |     | Light brown / grey coarse sand, 50% gravel and cobble, some construction debris present | 0                        |  | 2" Dia PVC |  |
| 1           |           |                |                |           |            |             |     |                                                                                         | 1                        |  |            |  |
| 2           |           | 1'             | 0-5'           | 2.4       |            |             |     |                                                                                         | 2                        |  |            |  |
| 3           |           |                |                |           |            |             |     |                                                                                         | 3                        |  |            |  |
| 4           |           |                |                |           |            |             |     |                                                                                         | 4                        |  |            |  |
| 5           |           |                |                |           |            |             |     | Historic fill, construction debris,, some coarse reddish brown sand present             | 5                        |  |            |  |
| 6           |           |                |                | 24.2      |            |             |     |                                                                                         | 6                        |  |            |  |
| 7           |           | 3'             | 5-10'          | 74.2      |            |             |     |                                                                                         | 7                        |  |            |  |
| 8           |           |                |                |           |            |             |     |                                                                                         | 8                        |  |            |  |
| 9           |           |                |                | 36.7      |            |             |     |                                                                                         | 9                        |  |            |  |
| 10          |           |                |                |           |            |             |     | Redish brown fine silt with red mottling and trace mica, 10% cobble and gravel          | 10                       |  |            |  |
| 11          |           |                |                | 3.4       |            |             |     |                                                                                         | 11                       |  |            |  |
| 12          |           | 4'             | 10-15'         | 2.1       |            |             |     |                                                                                         | 12                       |  |            |  |
| 13          |           |                |                | 0.0       |            |             |     |                                                                                         | 13                       |  |            |  |
| 14          |           |                |                | 0.0       |            |             |     |                                                                                         | 14                       |  |            |  |
| 15          |           |                |                |           |            |             |     | Reddish brown very ery coarse sand, 25% cobble and gravel                               | 15                       |  |            |  |
| 16          |           |                |                | 1.1       |            |             |     |                                                                                         | 16                       |  |            |  |
| 17          |           | 3'             | 15-20'         | 0.8       |            |             |     |                                                                                         | 17                       |  |            |  |
| 18          |           |                |                | 0.0       |            |             |     |                                                                                         | 18                       |  |            |  |
| 19          |           |                |                |           |            |             |     |                                                                                         | 19                       |  |            |  |
| 20          |           |                |                |           |            |             |     |                                                                                         | 20                       |  |            |  |
|             |           |                |                |           |            |             |     |                                                                                         |                          |  |            |  |

**KEY:**  
SPT = Standard Penetration Test  
CAL = Calibration  
BZ = Breathing Zone

SS = Split Spoon  
A = Auger Cuttings  
GP = Geoprobe

BH = Bore Hole  
GS = Grab Sample  
C = Composite

HS = Headspace  
V = Water Level  
TOB = Top of Bentonite

TOSC = Top of Screen  
TOS = Top of Sand  
CB = Curb Box

Grout  
 Bentonite  
 Sand  
 Screen

SP-SM  
 SM  
 SP  
 ROCK  
 SW

Page 1 of 1



| <b>Equity Environmental Engineering</b>              |           |                |                |           |            |             | CLIENT: <b>LPC Development Group LLC.</b>              |                                                       | SB/WELL ID: <b>MW-1</b>                   |               |
|------------------------------------------------------|-----------|----------------|----------------|-----------|------------|-------------|--------------------------------------------------------|-------------------------------------------------------|-------------------------------------------|---------------|
| 500 International Drive, Suite 150                   |           |                |                |           |            |             | PROJECT: <b>LPC</b>                                    |                                                       | PERMIT #:                                 |               |
| Mount Olive, New Jersey 07828                        |           |                |                |           |            |             | LOCATION: <b>95-105 South 5th Street, Brooklyn, NY</b> |                                                       |                                           |               |
| START DATE: <b>9/13/2018</b>                         |           |                |                |           |            |             | DRILLING CO.: <b>ADT</b>                               |                                                       | TOTAL DEPTH: <b>55'</b>                   |               |
| COMPLETION DATE: <b>9/13/2018</b>                    |           |                |                |           |            |             | DRILLER: <b>Brian and Patrick</b>                      |                                                       | WELL DEPTH: <b>55'</b>                    |               |
| BORING DIAMETER: <b>6"</b>                           |           |                |                |           |            |             | DRILL RIG / METHOD: <b>Sonic Rig</b>                   |                                                       | CASING ELEVATION: <b>N/A</b>              |               |
| WELL DIAMETER: <b>2"</b>                             |           |                |                |           |            |             | LOGGED BY: <b>John Vrabel</b>                          |                                                       | DEPTH TO WATER: <b>49.0'</b>              |               |
| SCREENED INTERVAL: <b>45'-55'</b>                    |           |                |                |           |            |             | WELL TYPE: <b>Flush Monitoring Well</b>                |                                                       | WATER LEVEL STATIC: <b>43.35'</b>         |               |
| SCREEN TYPE / SLOT: <b>2" diameter PVC/ 010 Slot</b> |           |                |                |           |            |             | FILTER PACK: <b># 2 Well Grade Sand</b>                |                                                       | CASING TYPE: <b>2" diameter SCH40 PVC</b> |               |
| Depth (Ft.)                                          | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample Type | H2O                                                    | Lithology / Remarks                                   | Boring/Well Construction                  |               |
| 20                                                   |           |                |                | 0.0       |            |             |                                                        | Reddish brown very coarse sand, 30% gravel and cobble | 20                                        | 2" Dia<br>PVC |
| 21                                                   |           |                |                |           |            |             |                                                        |                                                       |                                           |               |
| 22                                                   |           | 3'             | 20-25'         | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 23                                                   |           |                |                |           |            |             |                                                        |                                                       |                                           |               |
| 24                                                   |           |                |                | 0.0       |            |             |                                                        |                                                       | 24                                        |               |
| 25                                                   |           |                |                |           |            |             |                                                        |                                                       | 25                                        |               |
| 26                                                   |           |                |                | 0.0       |            |             |                                                        | Reddish brown coarse sand                             | 26                                        |               |
| 27                                                   |           |                |                | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 28                                                   |           | 5'             | 25-30'         | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 29                                                   |           |                |                | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 30                                                   |           |                |                | 0.0       |            |             |                                                        |                                                       | 30                                        |               |
| 31                                                   |           |                |                | 1.7       |            |             |                                                        | Yellowish grey coarse sand                            | 31                                        |               |
| 32                                                   |           |                |                | 2.3       |            |             |                                                        |                                                       |                                           |               |
| 33                                                   |           | 4'             | 30-35'         | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 34                                                   |           |                |                | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 35                                                   |           |                |                |           |            |             |                                                        |                                                       | 35                                        |               |
| 36                                                   |           |                |                | 3.3       |            |             |                                                        | Greyish brown coarse sand                             | 36                                        |               |
| 37                                                   |           |                |                | 2.7       |            |             |                                                        |                                                       |                                           |               |
| 38                                                   |           | 3'             | 35-40'         | 0.0       |            |             |                                                        |                                                       |                                           |               |
| 39                                                   |           |                |                |           |            |             |                                                        |                                                       |                                           |               |
| 40                                                   |           |                |                |           |            |             |                                                        |                                                       | 40                                        |               |
|                                                      |           |                |                |           |            |             |                                                        |                                                       |                                           |               |

**KEY:**

SPT = Standard Penetration Test

CAL = Calibration

BZ = Breathing Zone

SS = Split Spoon

A = Auger Cuttings

GP = Geoprobe

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

W = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Grout
 Bentonite
 Sand
 Screen

SP-SM
 SM
 SP
 ROCK
 SW

Page 1 of 1

[illegible]

| <b>Equity Environmental Engineering</b>              |           |                |                                         |           |            |                                   | CLIENT: <b>LPC Development Group LLC.</b>              |                                                  | SB/WELL ID: <b>MW-2</b>                   |  |        |  |
|------------------------------------------------------|-----------|----------------|-----------------------------------------|-----------|------------|-----------------------------------|--------------------------------------------------------|--------------------------------------------------|-------------------------------------------|--|--------|--|
| 500 International Drive, Suite 150                   |           |                |                                         |           |            |                                   | PROJECT: <b>LPC</b>                                    |                                                  | PERMIT #:                                 |  |        |  |
| Mount Olive, New Jersey 07828                        |           |                |                                         |           |            |                                   | LOCATION: <b>95-105 South 5th Street, Brooklyn, NY</b> |                                                  |                                           |  |        |  |
| START DATE: <b>9/13/2018</b>                         |           |                | DRILLING CO.: <b>ADT</b>                |           |            | TOTAL DEPTH: <b>50'</b>           |                                                        |                                                  |                                           |  |        |  |
| COMPLETION DATE: <b>9/14/2018</b>                    |           |                | DRILLER: <b>Brian and German</b>        |           |            | WELL DEPTH: <b>50'</b>            |                                                        |                                                  |                                           |  |        |  |
| BORING DIAMETER: <b>6"</b>                           |           |                | DRILL RIG / METHOD: <b>Sonic Rig</b>    |           |            | CASING ELEVATION: <b>N/A</b>      |                                                        |                                                  |                                           |  |        |  |
| WELL DIAMETER: <b>2"</b>                             |           |                | LOGGED BY: <b>John Vrabel</b>           |           |            | DEPTH TO WATER: <b>45.0'</b>      |                                                        |                                                  |                                           |  |        |  |
| SCREENED INTERVAL: <b>40'-50'</b>                    |           |                | WELL TYPE: <b>Flush Monitoring Well</b> |           |            | WATER LEVEL STATIC: <b>44.55'</b> |                                                        |                                                  |                                           |  |        |  |
| SCREEN TYPE / SLOT: <b>2" diameter PVC/ 010 Slot</b> |           |                |                                         |           |            |                                   | FILTER PACK: <b># 2 Well Grade Sand</b>                |                                                  | CASING TYPE: <b>2" diameter SCH40 PVC</b> |  |        |  |
| Depth (Ft.)                                          | Sample ID | Recovery (in.) | Interval (Ft.)                          | PID (ppm) | Reading At | Sample Type                       | H2O                                                    | Lithology / Remarks                              | Boring/Well Construction                  |  |        |  |
| 0                                                    |           |                |                                         | 3.1       |            |                                   |                                                        | Reddish brown medium silt, 15% gravel and cobble | 0                                         |  | 2" Dia |  |
| 1                                                    |           |                |                                         | 2.3       |            |                                   |                                                        |                                                  | 1                                         |  | PVC    |  |
| 2                                                    |           | 4'             | 0-5'                                    | 2.0       |            |                                   |                                                        |                                                  | 2                                         |  |        |  |
| 3                                                    |           |                |                                         | 1.9       |            |                                   |                                                        |                                                  | 3                                         |  |        |  |
| 4                                                    |           |                |                                         |           |            |                                   |                                                        |                                                  | 4                                         |  |        |  |
| 5                                                    |           |                |                                         |           |            |                                   |                                                        |                                                  | 5                                         |  |        |  |
| 6                                                    |           |                |                                         | 17.3      |            |                                   |                                                        | Redish brown medium sand, 10% gravel and cobble  | 6                                         |  |        |  |
| 7                                                    |           | 4'             | 5-10'                                   | 22.1      |            |                                   |                                                        |                                                  | 7                                         |  |        |  |
| 8                                                    |           |                |                                         | 16.8      |            |                                   |                                                        |                                                  | 8                                         |  |        |  |
| 9                                                    |           |                |                                         | 20.2      |            |                                   |                                                        |                                                  | 9                                         |  |        |  |
| 10                                                   |           |                |                                         |           |            |                                   |                                                        |                                                  | 10                                        |  |        |  |
| 11                                                   |           |                |                                         | 0.0       |            |                                   |                                                        | Redish brown medium sand                         | 11                                        |  |        |  |
| 12                                                   |           | 3'             | 10-15'                                  | 0.0       |            |                                   |                                                        |                                                  | 12                                        |  |        |  |
| 13                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                  | 13                                        |  |        |  |
| 14                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                  | 14                                        |  |        |  |
| 15                                                   |           |                |                                         |           |            |                                   |                                                        |                                                  | 15                                        |  |        |  |
| 16                                                   |           |                |                                         | 0.0       |            |                                   |                                                        | Redish brown medium sand, 30% gravel             | 16                                        |  |        |  |
| 17                                                   |           | 3'             | 15-20'                                  | 0.0       |            |                                   |                                                        |                                                  | 17                                        |  |        |  |
| 18                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                  | 18                                        |  |        |  |
| 19                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                  | 19                                        |  |        |  |
| 20                                                   |           |                |                                         |           |            |                                   |                                                        |                                                  | 20                                        |  |        |  |
|                                                      |           |                |                                         |           |            |                                   |                                                        |                                                  |                                           |  |        |  |

**KEY:**

SPT = Standard Penetration Test

CAL = Calibration

BZ = Breathing Zone

SS = Split Spoon

A = Auger Cuttings

GP = Geoprobe

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

W = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Grout  
 Bentonite  
 Sand  
 Screen

SP-SM  
 SM  
 SP  
 ROCK  
 SW

Page 1 of 1

| <b>Equity Environmental Engineering</b>              |           |                |                                         |           |            |                                   | CLIENT: <b>LPC Development Group LLC.</b>              |                                                     | SB/WELL ID: <b>MW-2</b>                   |               |
|------------------------------------------------------|-----------|----------------|-----------------------------------------|-----------|------------|-----------------------------------|--------------------------------------------------------|-----------------------------------------------------|-------------------------------------------|---------------|
| 500 International Drive, Suite 150                   |           |                |                                         |           |            |                                   | PROJECT: <b>LPC</b>                                    |                                                     | PERMIT #:                                 |               |
| Mount Olive, New Jersey 07828                        |           |                |                                         |           |            |                                   | LOCATION: <b>95-105 South 5th Street, Brooklyn, NY</b> |                                                     |                                           |               |
| START DATE: <b>9/13/2018</b>                         |           |                | DRILLING CO.: <b>ADT</b>                |           |            | TOTAL DEPTH: <b>50'</b>           |                                                        |                                                     |                                           |               |
| COMPLETION DATE: <b>9/14/2018</b>                    |           |                | DRILLER: <b>Brian and German</b>        |           |            | WELL DEPTH: <b>50'</b>            |                                                        |                                                     |                                           |               |
| BORING DIAMETER: <b>6"</b>                           |           |                | DRILL RIG / METHOD: <b>Sonic Rig</b>    |           |            | CASING ELEVATION: <b>N/A</b>      |                                                        |                                                     |                                           |               |
| WELL DIAMETER: <b>2"</b>                             |           |                | LOGGED BY: <b>John Vrabel</b>           |           |            | DEPTH TO WATER: <b>45.0'</b>      |                                                        |                                                     |                                           |               |
| SCREENED INTERVAL: <b>40'-50'</b>                    |           |                | WELL TYPE: <b>Flush Monitoring Well</b> |           |            | WATER LEVEL STATIC: <b>44.55'</b> |                                                        |                                                     |                                           |               |
| SCREEN TYPE / SLOT: <b>2" diameter PVC/ 010 Slot</b> |           |                |                                         |           |            |                                   | FILTER PACK: <b># 2 Well Grade Sand</b>                |                                                     | CASING TYPE: <b>2" diameter SCH40 PVC</b> |               |
| Depth (Ft.)                                          | Sample ID | Recovery (in.) | Interval (Ft.)                          | PID (ppm) | Reading At | Sample Type                       | H2O                                                    | Lithology / Remarks                                 | Boring/Well Construction                  |               |
| 20                                                   |           |                |                                         | 0.0       |            |                                   |                                                        | Light brown coarse sand, 15% gravel                 | 20                                        | 2" Dia<br>PVC |
| 21                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 22                                                   |           | 4'             | 20-25'                                  | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 23                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 24                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 25                                                   |           |                |                                         |           |            |                                   |                                                        | Dark Brown very coarse sand, 5% gravel and cobble   | 25                                        |               |
| 26                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 27                                                   |           | 3'             | 25-30'                                  | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 28                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 29                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 30                                                   |           |                |                                         |           |            |                                   |                                                        | Dark Brown very coarse sand, 5% gravel and cobble   | 30                                        |               |
| 31                                                   |           |                |                                         |           |            |                                   |                                                        |                                                     |                                           |               |
| 32                                                   |           | 3'             | 30-35'                                  | 1.2       |            |                                   |                                                        |                                                     |                                           |               |
| 33                                                   |           |                |                                         | 3.6       |            |                                   |                                                        |                                                     |                                           |               |
| 34                                                   |           |                |                                         | 1.0       |            |                                   |                                                        |                                                     |                                           |               |
| 35                                                   |           |                |                                         |           |            |                                   |                                                        | Light brown / grey medium-coarse sand, trace gravel | 35                                        |               |
| 36                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 37                                                   |           | 4'             | 35-40'                                  | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 38                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 39                                                   |           |                |                                         | 0.0       |            |                                   |                                                        |                                                     |                                           |               |
| 40                                                   |           |                |                                         |           |            |                                   |                                                        |                                                     | 40                                        |               |
|                                                      |           |                |                                         |           |            |                                   |                                                        |                                                     |                                           |               |

**KEY:**

SPT = Standard Penetration Test

CAL = Calibration

BZ = Breathing Zone

SS = Split Spoon

A = Auger Cuttings

GP = Geoprobe

BH = Bore Hole

GS = Grab Sample

C = Composite

HS = Headspace

W = Water Level

TOB = Top of Bentonite

TOSC = Top of Screen

TOS = Top of Sand

CB = Curb Box

Grout
 Bentonite
 Sand
 Screen

SP-SM
 SM
 SP
 ROCK
 SW

Page 1 of 1

| <b>Equity Environmental Engineering</b>              |           |                |                |           |            |             | CLIENT: <b>LPC Development Group LLC.</b>              |                                                                                          | SB/WELL ID: <b>MW-2</b>                   |  |  |               |  |
|------------------------------------------------------|-----------|----------------|----------------|-----------|------------|-------------|--------------------------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------|--|--|---------------|--|
| 500 International Drive, Suite 150                   |           |                |                |           |            |             | PROJECT: <b>LPC</b>                                    |                                                                                          | PERMIT #:                                 |  |  |               |  |
| Mount Olive, New Jersey 07828                        |           |                |                |           |            |             | LOCATION: <b>95-105 South 5th Street, Brooklyn, NY</b> |                                                                                          |                                           |  |  |               |  |
| START DATE: <b>9/13/2018</b>                         |           |                |                |           |            |             | DRILLING CO.: <b>ADT</b>                               |                                                                                          | TOTAL DEPTH: <b>50'</b>                   |  |  |               |  |
| COMPLETION DATE: <b>9/14/2018</b>                    |           |                |                |           |            |             | DRILLER: <b>Brian and German</b>                       |                                                                                          | WELL DEPTH: <b>50'</b>                    |  |  |               |  |
| BORING DIAMETER: <b>6"</b>                           |           |                |                |           |            |             | DRILL RIG / METHOD: <b>Sonic Rig</b>                   |                                                                                          | CASING ELEVATION: <b>N/A</b>              |  |  |               |  |
| WELL DIAMETER: <b>2"</b>                             |           |                |                |           |            |             | LOGGED BY: <b>John Vrabel</b>                          |                                                                                          | DEPTH TO WATER: <b>45.0'</b>              |  |  |               |  |
| SCREENED INTERVAL: <b>40'-50'</b>                    |           |                |                |           |            |             | WELL TYPE: <b>Flush Monitoring Well</b>                |                                                                                          | WATER LEVEL STATIC: <b>44.55'</b>         |  |  |               |  |
| SCREEN TYPE / SLOT: <b>2" diameter PVC/ 010 Slot</b> |           |                |                |           |            |             | FILTER PACK: <b># 2 Well Grade Sand</b>                |                                                                                          | CASING TYPE: <b>2" diameter SCH40 PVC</b> |  |  |               |  |
| Depth (Ft.)                                          | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample Type | H2O                                                    | Lithology / Remarks                                                                      | Boring/Well Construction                  |  |  |               |  |
| 40                                                   |           |                |                | 0.0       |            |             |                                                        | Light brown / grey medium-coarse sand, trace gravel<br>Ground water at approximately 45' | 0                                         |  |  | 2" Dia<br>PVC |  |
| 41                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 41                                        |  |  |               |  |
| 42                                                   |           | 4'             | 40-45'         | 0.0       |            |             |                                                        |                                                                                          | 42                                        |  |  |               |  |
| 43                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 43                                        |  |  |               |  |
| 44                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 44                                        |  |  |               |  |
| 45                                                   |           |                |                |           |            |             | ✓                                                      |                                                                                          | 45                                        |  |  |               |  |
| 46                                                   |           |                |                | 0.0       |            |             |                                                        | No Recovery, ground water at approximately 45'                                           | 46                                        |  |  |               |  |
| 47                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 47                                        |  |  |               |  |
| 48                                                   |           | 4'             | 45-50'         | 0.0       |            |             |                                                        |                                                                                          | 48                                        |  |  |               |  |
| 49                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 49                                        |  |  |               |  |
| 50                                                   |           |                |                |           |            |             |                                                        |                                                                                          | 50                                        |  |  |               |  |
| 51                                                   |           |                |                | 0.0       |            |             |                                                        | Light brown / grey coarse sand, soil saturated                                           | 51                                        |  |  |               |  |
| 52                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 52                                        |  |  |               |  |
| 53                                                   |           | 4'             | 50-55'         | 0.0       |            |             |                                                        |                                                                                          | 53                                        |  |  |               |  |
| 54                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                                          | 54                                        |  |  |               |  |
| 55                                                   |           |                |                |           |            |             |                                                        |                                                                                          | 55                                        |  |  |               |  |
|                                                      |           |                |                |           |            |             |                                                        |                                                                                          |                                           |  |  |               |  |
|                                                      |           |                |                |           |            |             |                                                        |                                                                                          |                                           |  |  |               |  |

**KEY:**  
SPT = Standard Penetration Test  
CAL = Calibration  
BZ = Breathing Zone

SS = Split Spoon  
A = Auger Cuttings  
GP = Geoprobe

BH = Bore Hole  
GS = Grab Sample  
C = Composite

HS = Headspace  
✓ = Water Level  
TOB = Top of Bentonite

TOSC = Top of Screen  
TOS = Top of Sand  
CB = Curb Box

 Grout  
 Bentonite  
 Sand  
 Screen

 SP-SM  
 SM  
 SP  
 ROCK  
 SW

| <b>Equity Environmental Engineering</b>              |           |                |                |           |            |             | CLIENT: <b>LPC Development Group LLC.</b>              |                                                                               | SB/WELL ID: <b>MW-3</b>                   |  |  |            |  |
|------------------------------------------------------|-----------|----------------|----------------|-----------|------------|-------------|--------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------------|--|--|------------|--|
| 500 International Drive, Suite 150                   |           |                |                |           |            |             | PROJECT: <b>LPC</b>                                    |                                                                               | PERMIT #:                                 |  |  |            |  |
| Mount Olive, New Jersey 07828                        |           |                |                |           |            |             | LOCATION: <b>95-105 South 5th Street, Brooklyn, NY</b> |                                                                               |                                           |  |  |            |  |
| START DATE: <b>10/23/2018</b>                        |           |                |                |           |            |             | DRILLING CO.: <b>ADT</b>                               |                                                                               | TOTAL DEPTH: <b>55'</b>                   |  |  |            |  |
| COMPLETION DATE: <b>10/23/2018</b>                   |           |                |                |           |            |             | DRILLER: <b>Brian and German</b>                       |                                                                               | WELL DEPTH: <b>55'</b>                    |  |  |            |  |
| BORING DIAMETER: <b>6"</b>                           |           |                |                |           |            |             | DRILL RIG / METHOD: <b>Sonic Rig</b>                   |                                                                               | CASING ELEVATION: <b>N/A</b>              |  |  |            |  |
| WELL DIAMETER: <b>2"</b>                             |           |                |                |           |            |             | LOGGED BY: <b>John Vrabel</b>                          |                                                                               | DEPTH TO WATER: <b>44.95</b>              |  |  |            |  |
| SCREENED INTERVAL: <b>40'-55'</b>                    |           |                |                |           |            |             | WELL TYPE: <b>Flush Monitoring Well</b>                |                                                                               | WATER LEVEL STATIC: <b>44.95</b>          |  |  |            |  |
| SCREEN TYPE / SLOT: <b>2" diameter PVC/ 010 Slot</b> |           |                |                |           |            |             | FILTER PACK: <b># 2 Well Grade Sand</b>                |                                                                               | CASING TYPE: <b>2" diameter SCH40 PVC</b> |  |  |            |  |
| Depth (Ft.)                                          | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample Type | H2O                                                    | Lithology / Remarks                                                           | Boring/Well Construction                  |  |  |            |  |
| 0                                                    |           |                |                |           |            |             |                                                        | Hand cleared to 5', concrete and fill material with reddish brown medium silt | 0                                         |  |  | 2" Dia PVC |  |
| 1                                                    |           |                |                |           |            |             |                                                        |                                                                               | 1                                         |  |  |            |  |
| 2                                                    |           | N/A            | 0-5'           | N/A       |            |             |                                                        |                                                                               | 2                                         |  |  |            |  |
| 3                                                    |           |                |                |           |            |             |                                                        |                                                                               | 3                                         |  |  |            |  |
| 4                                                    |           |                |                |           |            |             |                                                        |                                                                               | 4                                         |  |  |            |  |
| 5                                                    |           |                |                |           |            |             |                                                        |                                                                               | 5                                         |  |  |            |  |
| 6                                                    |           |                |                | 0.0       |            |             |                                                        | Redish brown medium sand                                                      | 6                                         |  |  |            |  |
| 7                                                    |           |                |                | 0.0       |            |             |                                                        |                                                                               | 7                                         |  |  |            |  |
| 8                                                    |           | 4'             | 5-10'          | 1.2       |            |             |                                                        |                                                                               | 8                                         |  |  |            |  |
| 9                                                    |           |                |                | 3.4       |            |             |                                                        |                                                                               | 9                                         |  |  |            |  |
| 10                                                   |           |                |                |           |            |             |                                                        |                                                                               | 10                                        |  |  |            |  |
| 11                                                   |           |                |                | 0.0       |            |             |                                                        | Redish brown medium silt, 10% med sands                                       | 11                                        |  |  |            |  |
| 12                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                               | 12                                        |  |  |            |  |
| 13                                                   |           | 4'             | 10-15'         | 0.0       |            |             |                                                        |                                                                               | 13                                        |  |  |            |  |
| 14                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                               | 14                                        |  |  |            |  |
| 15                                                   |           |                |                |           |            |             |                                                        |                                                                               | 15                                        |  |  |            |  |
| 16                                                   |           |                |                | 0.0       |            |             |                                                        | Redish brown medium sand                                                      | 16                                        |  |  |            |  |
| 17                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                               | 17                                        |  |  |            |  |
| 18                                                   |           | 4.5'           | 15-20'         | 0.0       |            |             |                                                        |                                                                               | 18                                        |  |  |            |  |
| 19                                                   |           |                |                | 0.0       |            |             |                                                        |                                                                               | 19                                        |  |  |            |  |
| 20                                                   |           |                |                |           |            |             |                                                        |                                                                               | 20                                        |  |  |            |  |
|                                                      |           |                |                |           |            |             |                                                        |                                                                               |                                           |  |  |            |  |

**KEY:**

SPT = Standard Penetration Test    SS = Split Spoon    BH = Bore Hole    HS = Headspace    TOSC = Top of Screen

CAL = Calibration    A = Auger Cuttings    GS = Grab Sample    W = Water Level    TOS = Top of Sand

BZ = Breathing Zone    GP = Geoprobe    C = Composite    TOB = Top of Bentonite    CB = Curb Box

Page 1 of 1

Grout
 Bentonite
 Sand
 Screen
 SP-SM
 SM
 SP
 ROCK
 SW

| <b>Equity Environmental Engineering</b><br><b>500 International Drive, Suite 150</b><br><b>Mount Olive, New Jersey 07828</b> |           |                |                |           |            |             | CLIENT: <b>LPC Development Group LLC.</b><br>PROJECT: <b>LPC</b><br>LOCATION: <b>95-105 South 5th Street, Brooklyn, NY</b> |                                                                                                   |    | SB/WELL ID: <b>MW-3</b><br>PERMIT #:      |  |            |  |
|------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|----------------|-----------|------------|-------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----|-------------------------------------------|--|------------|--|
| START DATE: <b>10/23/2018</b>                                                                                                |           |                |                |           |            |             | DRILLING CO.: <b>ADT</b>                                                                                                   |                                                                                                   |    | TOTAL DEPTH: <b>55'</b>                   |  |            |  |
| COMPLETION DATE: <b>10/23/2018</b>                                                                                           |           |                |                |           |            |             | DRILLER: <b>Brian and German</b>                                                                                           |                                                                                                   |    | WELL DEPTH: <b>55'</b>                    |  |            |  |
| BORING DIAMETER: <b>6"</b>                                                                                                   |           |                |                |           |            |             | DRILL RIG / METHOD: <b>Sonic Rig</b>                                                                                       |                                                                                                   |    | CASING ELEVATION: <b>N/A</b>              |  |            |  |
| WELL DIAMETER: <b>2"</b>                                                                                                     |           |                |                |           |            |             | LOGGED BY: <b>John Vrabel</b>                                                                                              |                                                                                                   |    | DEPTH TO WATER: <b>44.95</b>              |  |            |  |
| SCREENED INTERVAL: <b>40'-55'</b>                                                                                            |           |                |                |           |            |             | WELL TYPE: <b>Flush Monitoring Well</b>                                                                                    |                                                                                                   |    | WATER LEVEL STATIC: <b>44.95</b>          |  |            |  |
| SCREEN TYPE / SLOT: <b>2" diameter PVC/ 010 Slot</b>                                                                         |           |                |                |           |            |             | FILTER PACK: <b># 2 Well Grade Sand</b>                                                                                    |                                                                                                   |    | CASING TYPE: <b>2" diameter SCH40 PVC</b> |  |            |  |
| Depth (Ft.)                                                                                                                  | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample Type | H2O                                                                                                                        | Lithology / Remarks                                                                               |    | Boring/Well Construction                  |  |            |  |
| 20                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            | Brown medium silt, 25% gravel and cobble, 1 large boulder, patches of maroon medium silt          | 20 |                                           |  | 2" Dia PVC |  |
| 21                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 21 |                                           |  |            |  |
| 22                                                                                                                           |           | 4'             | 20-25'         | 0.0       |            |             |                                                                                                                            |                                                                                                   | 22 |                                           |  |            |  |
| 23                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 23 |                                           |  |            |  |
| 24                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 24 |                                           |  |            |  |
| 25                                                                                                                           |           |                |                |           |            |             |                                                                                                                            |                                                                                                   | 25 |                                           |  |            |  |
| 26                                                                                                                           |           |                |                | 10.2      |            |             |                                                                                                                            | Reddish brown / grey medium-fine silt, 15% gravel and cobble                                      | 26 |                                           |  |            |  |
| 27                                                                                                                           |           |                |                | 8.1       |            |             |                                                                                                                            |                                                                                                   | 27 |                                           |  |            |  |
| 28                                                                                                                           |           | 4'             | 25-30'         | 4.2       |            |             |                                                                                                                            |                                                                                                   | 28 |                                           |  |            |  |
| 29                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 29 |                                           |  |            |  |
| 30                                                                                                                           |           |                |                |           |            |             |                                                                                                                            |                                                                                                   | 30 |                                           |  |            |  |
| 31                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            | Reddish brown / grey medium-fine silt, 30% gravel and cobble                                      | 31 |                                           |  |            |  |
| 32                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 32 |                                           |  |            |  |
| 33                                                                                                                           |           | 4'             | 30-35'         | 0.0       |            |             |                                                                                                                            |                                                                                                   | 33 |                                           |  |            |  |
| 34                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 34 |                                           |  |            |  |
| 35                                                                                                                           |           |                |                |           |            |             |                                                                                                                            |                                                                                                   | 35 |                                           |  |            |  |
| 36                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            | Reddish brown medium sand, 30% gravel and cobble, soil moist<br>Ground water at approximately 37' | 36 |                                           |  |            |  |
| 37                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 37 |                                           |  |            |  |
| 38                                                                                                                           |           | 4'             | 35-40'         | 0.0       |            |             |                                                                                                                            |                                                                                                   | 38 |                                           |  |            |  |
| 39                                                                                                                           |           |                |                | 0.0       |            |             |                                                                                                                            |                                                                                                   | 39 |                                           |  |            |  |
| 40                                                                                                                           |           |                |                |           |            |             |                                                                                                                            |                                                                                                   | 40 |                                           |  |            |  |
|                                                                                                                              |           |                |                |           |            |             |                                                                                                                            |                                                                                                   |    |                                           |  |            |  |

**KEY:**  
 SPT = Standard Penetration Test  
 CAL = Calibration  
 BZ = Breathing Zone

SS = Split Spoon  
 A = Auger Cuttings  
 GP = Geoprobe

BH = Bore Hole  
 GS = Grab Sample  
 C = Composite

HS = Headspace  
 W = Water Level  
 TOB = Top of Bentonite

TOSC = Top of Screen  
 TOS = Top of Sand  
 CB = Curb Box

Grout  
 Bentonite  
 Sand  
 Screen

SP-SM  
 SM  
 SP  
 ROCK  
 SW

Page 1 of 1

[illegible]



## APPENDIX E

### EXCAVATION WORKPLAN

#### E-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B

**Table 1: Notifications\***

|                                                 |                                                                                                                                                                                                                         |
|-------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| NYSDEC Project Manager – Melissa Sweet          | (518) 402-9614<br>New York State Department of Environmental Conservation<br>625 Broadway, Albany, NY 12233-7015<br><a href="mailto:melissa.sweet@dec.ny.gov">melissa.sweet@dec.ny.gov</a>                              |
| NYSDEC Regional HW Engineer – Jane O<br>Connell | Jane O'Connell 718-482-4995<br>New York State Department of Environmental Conservation<br>47-40 21st Street Long Island City, NY 11101-5401<br><a href="mailto:jane.oconnell@dec.ny.gov">jane.oconnell@dec.ny.gov</a> ; |
| NYSDEC Site Control – Kelly Lewandowski         | Kelly Lewandowski (518)402-9553<br>New York State Department of Environmental Conservation<br>625 Broadway, Albany, NY 12233-7015<br><a href="mailto:Kelly.lewandowski@dec.ny.gov">Kelly.lewandowski@dec.ny.gov</a> ,   |

\* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;

- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix F of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

## **E-2 SOIL SCREENING METHODS**

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section B-4 of this appendix.

### **E-3 SOIL STAGING METHODS**

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC.

### **E-4 MATERIALS EXCAVATION AND LOAD-OUT**

A qualified environmental professional or person under their supervision will oversee all significant invasive work and the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the site will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

A truck decontamination station will be operated on-site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound

trucks will be decontaminated at the station before leaving the site until the activities performed under this section are complete. Truck decontamination waste will be collected and disposed of off-site in an appropriate manner.

Locations where vehicles enter or exit the site shall be inspected daily for evidence of off-site soil tracking.

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the site are clean of dirt and other materials derived from the site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

## **E-5 MATERIALS TRANSPORT OFF-SITE**

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Material transported by trucks exiting the site will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks loaded with site materials will exit the vicinity of the site using only approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from the site will be kept clean of dirt and other materials during site remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

## **E-6 MATERIALS DISPOSAL OFF-SITE**

All material excavated and removed from the site will be treated as contaminated and regulated material and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of material from this site is proposed for unregulated off-site disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

## **E-7 MATERIALS REUSE ON-SITE**

The probability of the reuse of excavated soil from the subject property is extremely low. If the need arises, the following will be required in accordance with DER-10 requirements:

- Procedure for determining if reuse is appropriate:
  - Sampling (methods and analytical)
  - Stockpile segregation scheme for on-site reuse
- Size of stockpiles, location (figure)

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the site will not be reused on-site.

## **E-8 FLUIDS MANAGEMENT**

All liquids to be removed from the site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

## **E-9 COVER SYSTEM RESTORATION**

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the decision document. The existing cover system is comprised of a minimum of 8-12 inches of clean stone and asphalt pavement or concrete covered sidewalks and concrete building, etc. The demarcation layer, will be replaced to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

## **E-10 BACKFILL FROM OFF-SITE SOURCES**

The probability that there will be a need for imported backfill is extremely low. Should there be a need for the import of backfill from an offsite source, the following will be provided:

- Source area approval following the DER-10 sampling and approval process
  - Sources of backfill material
  - Source area background check
- Chemical sampling for the appropriate analytes at the required frequency
  - Imported Soil Chemical Quality Standards
- Applicability of protection of groundwater SCOs
- Stockpile procedures for imported backfill material
  - Size of stockpiles, cover, etc.

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at <http://www.dec.ny.gov/regulations/67386.html>, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated sites will not be imported to the site.

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater and protection of ecological resources criteria, the resulting soil quality standards are the restricted residential standards. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

Trucks entering the site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

## **E-11 STORMWATER POLLUTION PREVENTION**

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the barrier and hay bale check functional.

All undercutting or erosion of the silt fence toe anchor shall be repaired immediately with appropriate backfill materials.

Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.



Erosion and sediment control measures identified in the SMP shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters.

Silt fencing or hay bales will be installed around the entire perimeter of the construction area.

## **E-12 EXCAVATION CONTINGENCY PLAN**

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

**E-13 COMMUNITY AIR MONITORING PLAN**

Given the configuration of the site, the air monitoring locations are limited to the driveway/parking lot and the South 5<sup>th</sup> Street side of the building. They will be adjusted on a daily or more frequent basis to the extent possible based on actual wind directions to provide an upwind and downwind monitoring stations.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

**E-14 ODOR CONTROL PLAN**

This odor control plan is capable of controlling emissions of nuisance odors off-site and on-site. Specific odor control methods to be used on a routine basis will include the necessary materials for the situation. At a minimum, the source will be covered, kept wet, and/or a chemical suppressant used. If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the

excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

#### **E-15 DUST CONTROL PLAN**

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

## **APPENDIX F**

### **HASP & CAMP**

Project Name: 105 South 5<sup>th</sup> Street  
Project Number: 2014074

**EQUITY ENVIRONMENTAL ENGINEERING, LLC**  
500 International Drive, Suite 150  
Mount Olive, New Jersey 07828

## **SITE-SPECIFIC CONSTRUCTION HEALTH AND SAFETY PLAN**

**Address: 105 South 5<sup>th</sup> Street  
Brooklyn, New York 11201**

### Plan Revisions

| <b>Number</b> | <b>Date</b> | <b>Initials</b> |
|---------------|-------------|-----------------|
| 1             | 5/6/15      | RLJ             |
| 2             | 7/6/16      | FU              |
| 3             |             |                 |
| 4             |             |                 |

Faron Moser  
Site Supervisor (SS)

\_\_\_\_\_  
Date

Robert Jackson  
Project Manager (PM)  
Health and Safety Officer  
Plan Preparer

\_\_\_\_\_  
Date

Neha Gautam  
Alternate Health & Safety Officer

\_\_\_\_\_  
Date

## Table of Contents

|                                                                        | <u>Page</u> |
|------------------------------------------------------------------------|-------------|
| Introduction.....                                                      | 2           |
| Site Information .....                                                 | 3           |
| Emergency Contacts .....                                               | 6           |
| Emergency Contact List Cell Phone Numbers .....                        | 6           |
| Key Project Personnel.....                                             | 8           |
| Medical Surveillance and Training Dates for Authorized Personnel ..... | 9           |
| Task Identification .....                                              | 10          |
| Chemical Hazards .....                                                 | 11          |
| Physical and Biological Hazards .....                                  | 12          |
| Risk Analysis .....                                                    | 13          |
| General Safety Rules.....                                              | 14          |
| Heat Stress .....                                                      | 15          |
| Cold Stress .....                                                      | 16          |
| Employee Training Program.....                                         | 17          |
| Personal Protective Equipment (PPE) Requirements .....                 | 19          |
| Suggested Levels of Protection.....                                    | 20          |
| Medical Surveillance .....                                             | 21          |
| Monitoring Requirements .....                                          | 22          |
| Air Monitoring and Contaminant Action Levels.....                      | 23          |
| Procedures for Handling Anticipated Wastes.....                        | 24          |
| Spill Prevention and Response.....                                     | 25          |
| Emergency Procedure .....                                              | 27          |
| Subcontractor Safety.....                                              | 31          |

### FORMS

- Job Safety & Health Protection
- HASP Sign-off
- Equipment Calibration Log
- Sampling Log
- Heat Stress Monitoring Log
- Daily Sign In/Sign Out
- Daily Safety Meeting Log
- Accident Injury Report
- Vehicle Accident Report
- Material Safety Data Sheets

## Introduction

This Site-Specific Health and Safety Plan (HASP) has been prepared by Equity Environmental Engineering, LLC (Equity) to summarize the work related health and safety hazards at the subject site (105 South 5<sup>th</sup> Street, Brooklyn, New York) and the requirements and procedures to protect its employees from them. This plan meets or exceeds the requirements of Occupational Safety and Health Administration (OSHA), 29 CFR 1910.120, for a site-specific health and safety plan.

This plan was designed to reduce the potential for occupational illness or injury resulting from working at this site. The purpose of the HASP is to inform Equity's employees of the health and safety risks present at this site, and the proper methods of protecting themselves from those risks. Each worker must be fully aware of the risks associated with the work to be accomplished, and be dedicated to completing that work safely.

Existing and potential hazards at this site have been identified. As new information becomes available, this HASP will be revised. Standard practices and procedures of industrial hygiene, occupational health, safety, and environmental protection are prescribed in this plan, which was prepared and reviewed by experienced professionals.

Equity employees who work on this site must read the HASP and sign the form included in this plan, to indicate that they understand the plan's contents, and agree to comply with its provisions. Anyone who cannot, or will not comply with this HASP will be excluded from on-site activities. Violations of this HASP or any applicable federal, state, or local health and safety regulations should be reported immediately to the Site Supervisor (SS), or to Equity's Health & Safety Officer (HSO).

This HASP will be readily available so workers can reference it when necessary.

## Site Information

Location: 105 South 5<sup>th</sup> Street, Brooklyn, NY 11201

### Current Site Information:

The subject property currently consists of a multi-story building located at 105 South 5<sup>th</sup> Street (Block 2443 /Lots 6, 37 and 41) in Brooklyn. This is an initial investigation of the subject property.

Location/Class:    ☒ Industrial            ☐ Commercial            ☐ Urban/Residential  
                         ☐ Suburban            ☐ Rural

Site Regulatory Status:            ☐ CERCLA/SARA            ☐ US EPA            ☐ NYCDEP  
                                         ☐ NPL                            ☐ RCRA            ☐ NJ ISRA  
                                         ☒ Other (OER)            ☐ Not Regulated

### Operations or Tasks to be Performed, and Approximate Duration of Each:

- 1- Subsurface geophysics survey**
- 2- Installation and sampling of soil borings, soil-gas points and monitoring wells.**
- 3- Excavation of contaminated soils.**
- 4- Back-fill with clean soil.**
- 5- Installation of vapor mitigation system**

### Surrounding Population/Structures:

The area surrounding the subject property is mixed residential and commercial/industrial.

### Site and Surrounding Topography:

The topography is generally flat.

### Known or Suspected Pathways of Contaminant Dispersion:

None

### Emergency Shower, Eyewash and First Aid Equipment Located at:

Eyewash and emergency shower will be available.

First aid provided by emergency services (911).

### Personnel On-Site trained in First Aid:

|                      |          |
|----------------------|----------|
| 1. <u>N. Gautam</u>  | 5. _____ |
| 2. <u>F. Moser</u>   | 6. _____ |
| 3. <u>B. Jackson</u> | 7. _____ |
| 4. <u>P. Jaran</u>   | 8. _____ |



# Emergency Medical Care

## Hospital

Hospital Name: SUNY Downstate Medical Center

Telephone #: 888-270-7869

Address: 450 Clarkson Ave, Brooklyn, NY 11203

Contact: Operator

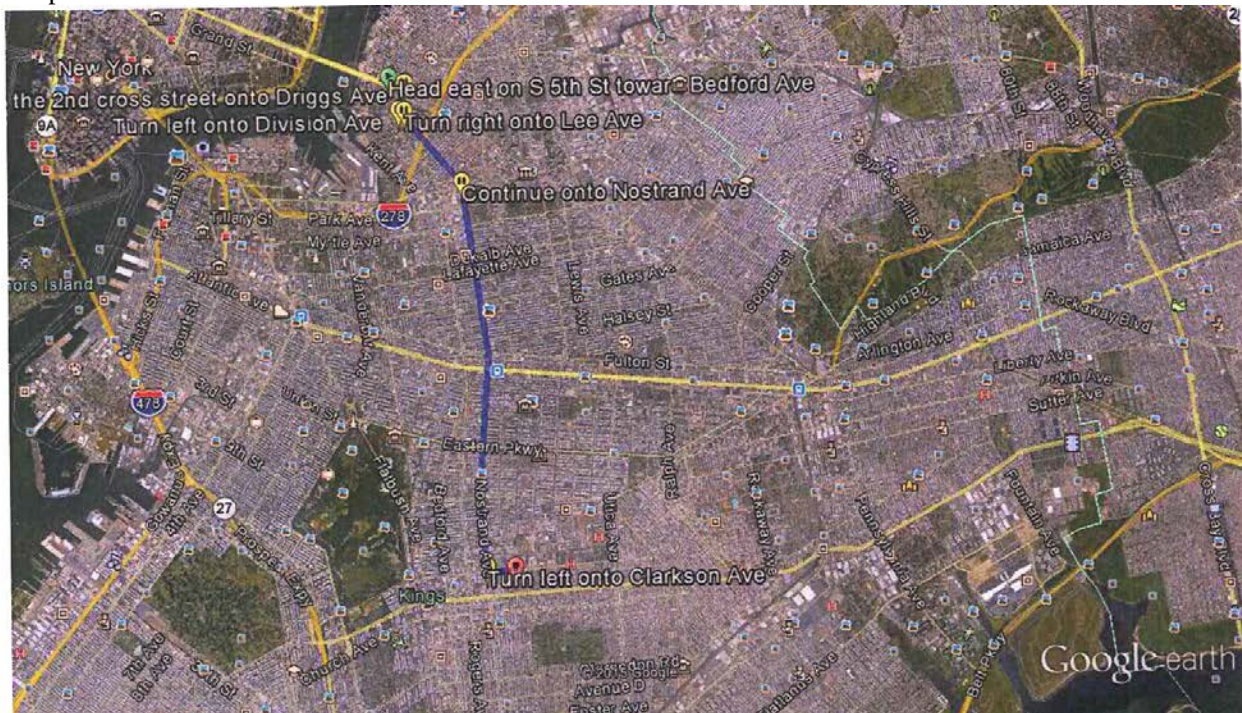
Telephone #: 888-270-7869

Type of Service (X) Physical Trauma Only

( ) Physical Trauma and Chemical Exposure

( ) Available 24 Hours

Hospital Route:



1. Head east on S 5<sup>th</sup> St 0.1 mi
2. Turn right onto Driggs Ave 0.2 mi
3. Turn left onto Division Ave 0.2 mi
4. Turn right onto Lee Ave 0.7 mi
5. Continue onto Nostrand Ave 3.1 mi
6. Turn left onto Clarkson Ave – 0.2 mi

**\*\*Hospital route information has been provided to satisfy OSHA requirements (29 CFR 1910.120). However, where 911-emergency service and/or transport is available, Equity personnel are strictly prohibited from transporting accident victims in either company or personal vehicles.**

Transporting the injured in non-emergency vehicles increases the potential for motor vehicle accidents during transit to the hospital and further injury to the victim. Also, the victims' condition can worsen during transit. As a result, transportation in non-emergency vehicles can delay or even prevent treatment by trained emergency personnel during a critical time. Employees must remain at the site of the accident, administer appropriate first aid, and await the arrival of **trained emergency and/or rescue personnel**.

## Emergency Contacts

|                               | <b>Town</b>         | <b>Phone</b>         |
|-------------------------------|---------------------|----------------------|
| Fire Department               | NYC                 | 911                  |
| Police Department             | NYC                 | 911 / (212) 334-0611 |
| Site Contact                  | Equity Personnel    | (973) 641-0825       |
| Site Telephone                | Equity Personnel    | (973) 641-0825       |
| Nearest Telephone             | Equity Personnel    | TBD                  |
| First Aid/EMS                 | NYC                 | 911                  |
| Federal Agency Representative | NA                  | NA                   |
| State Agency Representative   | NA                  | NA                   |
| Local Agency Representative   | NA                  | NA                   |
| Pesticide Poisoning           | NA                  | (800) 845-7633       |
| NY Poison Control Center      | State-wide          | (212) 764-7667       |
| CHEM TREC                     | Washington, DC      | (800) 424-9300       |
| <b>Utility</b>                | <b>Company Name</b> | <b>Phone</b>         |
| Water Supply                  | NYC DEP             | *                    |
| Sewer                         | NYC DEP             | *                    |
| Power                         | Con Edison          | *                    |
| Telephone                     | *                   | *                    |
| Gas                           | National Grid       | *                    |
| NY One Call                   | NY                  | 811                  |

\* NY One Call will supply this information

Equity Environmental Engineering LLC Emergency Contact List  
Cell Phone Numbers

|             |                |
|-------------|----------------|
| Peter Jaran | (973) 479-2381 |
| Bob Jackson | (973) 641-0825 |
| Faron Moser | (201) 341-1323 |
| Neha Gautam | (201) 916-3416 |
|             |                |
|             |                |
|             |                |
|             |                |
|             |                |
|             |                |
|             |                |

## Key Project Personnel

The following describes the project position assignments, associated responsibilities, and reporting relationships.

| Position                      | Job Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Interactions                                                                                    |
|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Project Manager (PM)          | Responsible for technical and administrative performance of the project. Supports Site Supervisor and is available to him at all times. Will visit the site periodically, or as necessary. Reports progress of project on a regular basis. Assigns key personnel, and identifies, requests, secures, and monitors use of resources for project. Approves program expenditures and invoices.                                                                                                               | Reports directly to Managing Director. Works closely with Site Supervisor.                      |
| Site Supervisor (SS)          | Acts as point of contact for client and client's representative(s). Supervises all on-site personnel and subcontractors. Coordinates daily site-specific work efforts, and ensures all activities are in strict compliance with site-specific health and safety plan. Has authority to suspend all work that possesses any health and safety risk. Briefs subordinate technical personnel on task requirements. Identifies and resolves technical problems. Provides periodic review of project progress. | Reports directly to Project Manager.                                                            |
| Health & Safety Officer (HSO) | Develops, implements, and enforces the on-site safety program. Oversees all health and safety aspects of project, conducts periodic audits to ensure compliance. Available at all times to discuss project progress and health and safety related issues.                                                                                                                                                                                                                                                 | Reports directly to Managing Director. Works closely with Project Manager, and Site Supervisor. |
| Onsite Health Physicist       | Implementing the radiation safety at the Site with authorization to stop work due to unsafe acts, unsafe conditions, non-compliance and/or non-implementation of the Safety Plan and/or applicable safety and health requirements; performs the proper operation of radiation monitoring equipment; conducts radiation surveys; and notifies anomalies to the site supervisor.                                                                                                                            | Reports directly to Site Supervisor.                                                            |

Equity is the entity responsible for managing health and safety for its employees at this site. Key project personnel are as follows:

|                  |                    |                                  |
|------------------|--------------------|----------------------------------|
| Project Manager: | Robert Jackson     | <u>973-527-7451/974-641-0825</u> |
| HSO              | Name               | Telephone / Cellular Number      |
| Site Supervisor: | <u>Faron Moser</u> | <u>973-527-7451/201-341-1323</u> |
|                  | Name               | Telephone / Cellular Number      |
| Alternate SSO:   | Neha Gautam        | <u>973-527-7451/201-916-3416</u> |
|                  |                    | Telephone / Cellular Number      |

## Medical Surveillance and Training Dates for Authorized Personnel

| <b>Employee</b> | <b>Medical Exam</b> | <b>OSHA 8-Hr.</b> | <b>Site Supervisor Training</b> | <b>Respirator Fit Test</b> |
|-----------------|---------------------|-------------------|---------------------------------|----------------------------|
| Bob Jackson     | 12/12/14            | 11/11/2013        | 9/27/2004                       | 12/13/2012                 |
| Peter Jaran     | 12/16/14            | 11/11/2013        |                                 | 12/13/2012                 |
| Faron Moser     | 4/1/2014            | 1/28/2014         |                                 |                            |
| Neha Gautam     | 3/4/2014            | 6/25/2013         |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |
|                 |                     |                   |                                 |                            |

## Task Identification

Tasks covered under this plan:

| Task # | Description                                                        |
|--------|--------------------------------------------------------------------|
| 1      | Surface geophysics Survey                                          |
| 2      | Installation of soil borings, soil-gas points and monitoring wells |
| 3      | Collection of soil, soil-gas and groundwater samples.              |
| 4      | Excavation of contaminated soils                                   |
| 5      | Back-fill with clean soil                                          |
| 6      | Installation of vapor mitigation system                            |
|        |                                                                    |
|        |                                                                    |
|        |                                                                    |
|        |                                                                    |
|        |                                                                    |
|        |                                                                    |

Off-site tasks planned? No

Describe: \_\_\_\_\_

\_\_\_\_\_

## Chemical Hazards

| Task No.(s) | Chemical Name (or class)          | PEL                   | TLV                     | Other Pertinent Limits (specify) | Primary Hazard |        |            | SDS Attached (Y/N) |
|-------------|-----------------------------------|-----------------------|-------------------------|----------------------------------|----------------|--------|------------|--------------------|
|             |                                   |                       |                         |                                  | Ingestion      | Dermal | Inhalation |                    |
| 2, 3        | Isobutylene (PID Calibration Gas) | 250 ppm               | 250 ppm                 |                                  | x              | x      | x          | Y                  |
| 2,3 and 4   | Benzo(a) anthracene*              | 0.2 mg/m <sup>3</sup> | 0.2 mg/m <sup>3</sup>   |                                  | x              | x      | x          | Y                  |
| 2,3 and 4   | Benzo(a)pyrene*                   | 0.2 mg/m <sup>3</sup> | 0.2 mg/m <sup>3</sup>   |                                  | x              | x      | x          | Y                  |
| 2,3 and 4   | Benzo(b) fluoranthene*            | 0.2 mg/m <sup>3</sup> | 0.2 mg/m <sup>3</sup>   |                                  | x              | x      | x          | Y                  |
| 2,3 and 4   | Chrysene *                        | 0.2 mg/m <sup>3</sup> | 0.2 mg/m <sup>3</sup>   |                                  | x              | x      | x          | Y                  |
| 2,3 and 4   | Indeno (1,2,3-cd) Pyrene*         | 0.2 mg/m <sup>3</sup> | 0.2 mg/m <sup>3</sup>   |                                  | x              | x      | x          | Y                  |
| 2,3 and 4   | Mercury                           | 0.1 mg/m <sup>3</sup> | 0.025 mg/m <sup>3</sup> |                                  | x              | x      | x          | Y                  |
|             |                                   |                       |                         |                                  |                |        |            |                    |

\* Values based on OSHA Coal tar pitch volatiles (benzene soluble fraction), anthracene, BaP, phenanthrene, acridine, chrysene, pyrene)

- PEL – OSHA Permissible Exposure Limit: the maximum allowable 8-hour time weighted average (TWA) exposure concentration.  
 TLV – ACGIH Threshold Limit Value: the recommended 8-hour TWA exposure concentration.  
 STEL – ACGIH or OSHA Short-term Exposure Limit: the maximum allowable 15-minute TWA exposure concentration.  
 Ceiling – OSHA and Cal-OSHA Ceiling Limit: the maximum exposure concentration above, which an employee shall not be exposed during any period without respiratory protection.  
 IDLH – Immediately Dangerous to Life and Health: the concentration at which one could be exposed for 30 minutes without experiencing escape-impairing or irreversible health effects.



### Physical and Biological Hazards

| Hazard                         | Yes | No | Task No.(s) | Hazard                                  | Yes | No | Task No.(s) |
|--------------------------------|-----|----|-------------|-----------------------------------------|-----|----|-------------|
| Electrical (overhead lines)    |     | X  | 1,2,3,4,5   | Uneven Terrain                          |     | X  |             |
| Electrical (underground lines) | X   |    | 1,2,3,4,5   | Unstable Surfaces                       | X   |    | 1,2,3,4,5   |
| Gas Lines                      | X   |    | 1,2,3,4,5   | Elevated Surfaces                       |     | X  |             |
| Water Lines                    | X   |    | 1,2,3,4,5   | Lightning                               | X   |    | 1,2,3,4,5   |
| Drilling Equipment             | X   |    | 1,2,3,4,5   | Rain                                    | X   |    | 1,2,3,4,5   |
| Excavation Equipment           | X   |    | 1,2,3,4,5   | Snow                                    | X   |    | 1,2,3,4,5   |
| Power Tools                    | X   |    | 1,2,3,4,5   | Liquefied/Pressurized Gases             |     | X  |             |
| Heat Exposure                  | X   |    | 1,2,3,4,5   | Lifting Equipment                       |     | X  |             |
| Cold Exposure                  | X   |    | 1,2,3,4,5   | Vermin                                  | X   |    | 1,2,3,4,5   |
| Oxygen Deficiency              |     | X  |             | Insects                                 | X   |    | 1,2,3,4,5   |
| Confined Spaces                |     | X  |             | Disease-causing organisms               | X   |    | 1,2,3,4,5   |
| Noise                          | X   |    | 1,2,3,4,5   | Others, e.g., marine sampling (specify) |     | X  |             |
| Ionizing Radiation             |     | X  |             |                                         |     |    |             |
| Non-Ionizing Radiation         |     | X  |             |                                         |     |    |             |
| Fire                           | X   |    | 1,2,3,4,5   |                                         |     |    |             |
| Explosive Atmospheres          |     | X  |             |                                         |     |    |             |
| Shoring                        | X   |    | 1,2,3,4,5   |                                         |     |    |             |
| Scaffolding                    |     | X  |             |                                         |     |    |             |
| Holes/Ditches                  | X   |    | 1,2,3,4,5   |                                         |     |    |             |
| Steep Grades                   |     | X  |             |                                         |     |    |             |
| Slippery Surfaces              | X   |    | 1,2,3,4,5   |                                         |     |    |             |

## Risk Analysis

| Task #    | Substance                         | Concentration (if known) | Risk* |
|-----------|-----------------------------------|--------------------------|-------|
| 1,2,3     | Isobutylene (PID Calibration Gas) | 250 ppm                  | 1     |
| 2,3 and 4 | Benzo(a) anthracene               | 1.39 mg/kg               | 1     |
| 2,3 and 4 | Benzo(a)pyrene                    | 1.25 mg/kg               | 1     |
| 2,3 and 4 | Benzo(b) fluoranthene             | 1.62 mg/kg               | 1     |
| 2,3 and 4 | Chrysene                          | 1.31 mg/kg               | 1     |
| 2,3 and 4 | Indeno (1,2,3-cd) Pyrene          | 0.957 mg/kg              | 1     |
| 2,3 and 4 | Mercury                           | 0.97 mg/kg               | 1     |
|           |                                   |                          |       |
|           |                                   |                          |       |
|           |                                   |                          |       |
|           |                                   |                          |       |
|           |                                   |                          |       |
|           |                                   |                          |       |

\*Risk

- 0 – No Risk
- 1 – Slight Risk
- 2 – Moderate Risk
- 3 – Dangerous Conditions/Caution
- 4 – High Risk
- 5 – Extremely Dangerous

## General Safety Rules

1. If an employee must work alone, he/she must call his/her supervisor twice a day. If the supervisor is unavailable, that supervisor's supervisor must be contacted.
2. Workers must wear all personal protective equipment required for the tasks to be performed.
3. Horseplay or practical jokes are forbidden on the job.
4. Compressed air must not be used to blow dirt from clothing, or played with or blown at another person.
5. Drinking of alcoholic beverages or the use of drugs on the job is prohibited. Their use will cause immediate dismissal from the site.
6. All areas must be continually cleaned to maintain good housekeeping. Trash is to be piled neatly and removed promptly. All tools and work areas are to be kept in clean and safe condition.
7. Competent workers must do welding and cutting.
8. Ladders are to be of proper design and tied off while in use. Do not go up or down a ladder without the free use of both hands. Use a rope to lift or lower materials or tools. Always face a ladder when climbing or descending.
9. Every work site must have a complete first aid kit.
10. **ALL** accidents must be investigated and reported. Use the Accident Investigation Form in the back section of this plan.
11. Injuries sustained while on duty must be reported to supervisor immediately, or as soon as possible after injury is sustained.
12. Explosives must be handled and transported by licensed people only.
13. All tools and electrical equipment must be in proper working order.
14. Clothing appropriate to the duties performed shall be worn by all workers. Large pockets, loose jewelry, cuffed trousers and loose or torn clothing are dangerous and should not be worn around machinery, or when climbing ladders, or working on structures.

## Heat Stress

Site employees will be trained to recognize signs of heat stress. The Site Supervisor will maintain a log of all site employees exposed to temperature extremes, showing the work and rest times as well as worker monitoring results. Appropriate rest periods will be provided to help site workers accommodate to temperature extremes.

### Signs and Symptoms of Heat Stress

- **Heat rash** may result from continuous exposure to heat or humid air.
- **Heat cramps** are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include:
  - muscle spasms
  - pain in the hands, feet and abdomen
- **Heat exhaustion** occurs from increased stress on various body organs, including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms are:
  - pale, cool, moist skin
  - heavy sweating
  - dizziness
  - nausea
  - fainting
- **Heat stroke** is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occurs. Competent medical help must be obtained. Signs and symptoms are:
  - red, hot, usually dry skin
  - lack of reduced perspiration
  - nausea
  - dizziness and confusion
  - strong, rapid pulse
  - coma

### Measures to Avoid Heat Stress

- Establish work-rest cycles (short and frequent are more beneficial than long and seldom).
- Identify a shaded, cool rest area.
- Rotate personnel, alternate job functions.
- Water intake should be equal to the sweat produced. Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst. **DO NOT DEPEND ON THIRST TO SIGNAL WHEN AND HOW MUCH TO DRINK.** For an 8-hour workday, 50 ounces of fluids should be drunk.
- Eat lightly salted foods or drink salted drinks such as Gatorade to replace lost salt.
- Save most strenuous tasks for non-peak hours, such as the early morning or at night.
- Avoid alcohol during prolonged periods of heat. Alcohol will cause additional dehydration.

Site personnel should monitor their pulse rate as an indicator of heat strain by the following method:

At the beginning of the rest period, count the radial pulse during a 30-second period. If the rate exceeds 110 beats per minute, lengthen the rest period by one-third. If the heart rate still exceeds 110 beats per minute at the end of the rest period, shorten the next work cycle by one-third.

## Cold Stress

Equity will provide appropriate rest periods to help site workers accommodate to temperature extremes. Site employees will be trained to recognize signs of cold stress.

### Measures to Avoid Cold Stress

- Wear multi-layer clothing (the outer most layer should be of wind-resistant fabric)
- Drink warm fluids
- Work in pairs
- Avoid heavy sweating

### Cooling Power of Wind on Exposed Flesh Expressed as Equivalent Temperature (under calm conditions)\*

| Estimated<br>Wind Speed (in<br>mph)                                          |                                                                                          |    |    |     |                                                                                     |     |     |     |                                                        |      |      |      |
|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----|----|-----|-------------------------------------------------------------------------------------|-----|-----|-----|--------------------------------------------------------|------|------|------|
|                                                                              | 50                                                                                       | 40 | 30 | 20  | 10                                                                                  | 0   | -10 | -20 | -30                                                    | -40  | -50  | -60  |
|                                                                              | Equivalent Chill Temperature (°F)                                                        |    |    |     |                                                                                     |     |     |     |                                                        |      |      |      |
| Calm                                                                         | 50                                                                                       | 40 | 30 | 20  | 10                                                                                  | 0   | -10 | -20 | -30                                                    | -40  | -50  | -60  |
| 5                                                                            | 48                                                                                       | 37 | 27 | 16  | 6                                                                                   | -5  | -15 | -26 | -36                                                    | -47  | -57  | -68  |
| 10                                                                           | 40                                                                                       | 28 | 16 | 4   | -9                                                                                  | -24 | -33 | -46 | -58                                                    | -70  | -83  | -95  |
| 15                                                                           | 36                                                                                       | 22 | 9  | -5  | -18                                                                                 | -32 | -45 | -58 | -72                                                    | -85  | -99  | -112 |
| 20                                                                           | 32                                                                                       | 18 | 4  | -10 | -25                                                                                 | -39 | -53 | -67 | -82                                                    | -96  | -110 | -121 |
| 25                                                                           | 30                                                                                       | 16 | 0  | -15 | -29                                                                                 | -44 | -59 | -74 | -88                                                    | -104 | -118 | -133 |
| 30                                                                           | 28                                                                                       | 13 | -2 | -18 | -33                                                                                 | -48 | -63 | -79 | -94                                                    | -109 | -125 | -140 |
| 35                                                                           | 27                                                                                       | 11 | -4 | -20 | -35                                                                                 | -51 | -67 | -82 | -98                                                    | -113 | -129 | -195 |
| 40                                                                           | 26                                                                                       | 10 | -6 | -21 | -37                                                                                 | -53 | -69 | -85 | -100                                                   | -116 | -132 | -148 |
| (Wind speeds<br>greater than 40<br>mph have little<br>additional<br>effect). | LITTLE DANGER<br>In <hr. with dry skin.<br>Maximum danger of false<br>sense of security. |    |    |     | INCREASING DANGER<br>Danger from freezing of<br>exposed flesh within one<br>minute. |     |     |     | GREAT DANGER<br>Flesh may freeze within 30<br>seconds. |      |      |      |
|                                                                              | Trench foot and immersion foot may occur at any point on this chart                      |    |    |     |                                                                                     |     |     |     |                                                        |      |      |      |

\* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, MA

The Site Supervisor will maintain a log of all site employees exposed to temperature extremes, showing the work and rest times as well as environmental monitoring results.

## **Employee Training Program**

All personnel performing work in areas on this site covered by this HASP must have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual must have completed an 8-hour refresher-training course and/or initial 40-hour training course within the last two years prior to performing any intrusive work on this site covered by this HASP. Records that demonstrate that all persons subject to the training requirements have actually met them will be maintained either on site or in the project file. The Project Manager and/or Supervisor are responsible for verifying compliance of the project team with these rules.

Prior to commencement of on-site activities, a site safety meeting will be held to review the specific information and requirements of this HASP. HASP sign-off sheets will be collected at the end of this meeting.

Site Specific Training (when applicable) will include:

- Explanation of the overall site HASP.
- Health and safety personnel and organization.
- Brief site history.
- Special attention to signs and symptoms of overexposure to known and suspected site contaminants.
- Health effects of site contaminants.
- Air monitoring description.
- Physical hazards associated with the project.
- Selection, use and limitations of available safety.
- Personal hygiene and decontamination.
- Respirator face-piece fit testing.
- PPE use and maintenance.
- Site rules and regulations.
- Work zone establishment and markings.
- Site communication.
- Emergency preparedness procedures.
- Equipment decontamination.
- Medical monitoring procedures.
- Contingency plan.

Prior to work, each Equity employee will attend the contractor's health and safety orientation, if applicable. In addition, Equity's employees will review health and safety items specific to the tasks to be performed that were not covered in the contractor's orientation.

## **Site Health and Safety Meetings**

In addition, the Site Supervisor will meet daily with all Equity employees prior to beginning work on site. The agenda of the meeting will include a review of important elements of this plan, any special safety items, and a discussion of the emergency response procedures. Also, everyone will agree on a schedule for periodic meetings, (for example, before beginning work each day), to review the effectiveness of this plan and make changes as necessary. If significant changes at the site occur, special meetings will be scheduled.

## **Training Records**

The Site Supervisor will complete a report of the daily safety meetings, using the form in the back section of this plan, and all attending the meeting will sign the Daily Safety Meeting Log.

The training status of contractor and subcontractor employees will be verified that their training criteria meets the requirements specified in 29 CFR 1910.120(e). A copy of all training certificates will be kept for Equity personnel working at the site.

## Personal Protective Equipment (PPE) Requirements

| Task No.(s)                                                                                                                                                                                                                                                                                                                                                                     | Level of Protection (A – D)* | Level of Upgrade | PPE Suit | PPE Gloves                                                                                                                                                                                                                                                                                                                        | PPE Feet | PPE Head | PPE Eye | PPE Ear                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | PPE Respirator | Additional PPE for Upgrade |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------|------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|----------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------|
| 1,2,3                                                                                                                                                                                                                                                                                                                                                                           | D                            | NA               | Std      | N                                                                                                                                                                                                                                                                                                                                 | Steel    | HH       | Glasses | Plugs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | NA             |                            |
|                                                                                                                                                                                                                                                                                                                                                                                 |                              |                  |          |                                                                                                                                                                                                                                                                                                                                   |          |          |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                 |                              |                  |          |                                                                                                                                                                                                                                                                                                                                   |          |          |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                 |                              |                  |          |                                                                                                                                                                                                                                                                                                                                   |          |          |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                 |                              |                  |          |                                                                                                                                                                                                                                                                                                                                   |          |          |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                            |
|                                                                                                                                                                                                                                                                                                                                                                                 |                              |                  |          |                                                                                                                                                                                                                                                                                                                                   |          |          |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                |                            |
| <u>SUIT</u><br><br>Std = Standard Work Clothes<br>Tyvek = Uncoated Tyvek Disposal Coverall<br>PE Tyvek = Polyethylene-coated Tyvek<br>Saranex = Saranex-laminated Tyvek<br>PVC Suite = PVC Raingear<br><br><u>GLOVES</u><br><br>Work = Work Gloves (canvas, leather)<br>Neo = Neoprene Gloves<br>PVC = PVC Gloves<br>N = Nitrile Gloves<br>V = Vinyl Gloves<br>L = Latex Gloves |                              |                  |          | <u>FEET</u><br><br>Steel = Steel-toe shoes or boots<br>Steel+ = Steel-toe shoes or boots & PVC boots<br>Booties = PVC booties<br><br><u>HEAD</u><br><br>HH = Hardhat<br><br><u>EYE</u><br><br>Glasses = Safety glasses<br>Goggles = Goggles<br>Shield = Face shield<br><br><u>EAR</u><br><br>Plugs = Earplugs<br>Muff = Ear muffs |          |          |         | <u>RESPIRATOR</u><br><br>APR = Air purifying respirator<br>Full APR = Full face APR<br>Half APR = Half face APR<br>SAR = Airline supplied air respirator<br>SCBA = Self-contained breathing apparatus<br>Escape = Escape SCBA<br>OV = Organic Vapor Cartridge<br>AG = Acid Gas Cartridge<br>OV/AG = Organic Vapor/Acid Gas Cartridge<br>AM = Ammonia Cartridge<br>Dust/Mist = Dust/Mist pre-filter and cover for cartridge<br>HEPA = High efficiency particulate air filter cartridge |                |                            |

\* For unspecified volatile organics (based on 1-minute breathing zone measurement using PID or OVA):

|                              |         |
|------------------------------|---------|
| Up to 1 ppm above background | Level D |
| 1 – 5 ppm above background   | Level C |
| 5 – 500 ppm above background | Level B |
| 500 ppm above background     | Level A |

\*\* Earplugs will be available on-site, but are not required



## Suggested Levels of Protection

### Level “D” Protection

1. Coveralls (optional)
2. Gloves
3. Boots/shoes – steel toe
4. Boots (outer) chemical resistant (disposable- if required)
5. Safety glasses or chemical splash goggles
6. Hard hat (safety shield if required)

### Level “C” Protection

1. Full-face, air-purifying, canister-equipped respirator (NIOSH/MSHA approved)
2. Chemical resistant clothing (coveralls; hooded, two-piece, chemical splash suit; chemical resistant hood & apron; disposable, chemical-resistant coveralls)
3. Coveralls
4. Gloves (outer) chemical-resistant
5. Gloves (inner) chemical-resistant
6. Boots (outer) chemical-resistant
7. Boots (inner) steel toe
8. Hard hat (face shield)
9. Escape mask
10. Two-way radio

### Level “B” Protection

1. Pressure/Demand SCBA (MSHA-NIOSH approved)
2. Chemical resistant clothing (coveralls and long-sleeved jacket; coveralls; hooded, one- or two-piece chemical splash suite; disposable, chemical-resistant coveralls)
3. Coveralls
4. Gloves (outer) chemical-resistant
5. Gloves (inner) chemical-resistant
6. Boots (outer) chemical-resistant
7. Boots (inner) steel toe
8. Hard hat (face shield)
9. Two-way radio

### Level “A” Protection (Equity does not perform work in Level A PPE)

1. Pressure/Demand SCBA (MSHA-NIOSH approved)
2. Fully encapsulating, chemical-resistant suit
3. Coveralls
4. Gloves (outer) chemical-resistant
5. Gloves (inner) chemical-resistant
6. Boots, chemical-resistant, steel toe (depending on suit construction, work over or under suit boot)
7. Hard hat (under suit)
8. Two-way radio

# Medical Surveillance

## Requirements

All Equity employees covered by this HASP, who engage in site activities governed by 29 CFR 1910.120 for 30 or more days per year, must meet the medical surveillance requirements specified in 1910.120(f). Therefore, such personnel must have completed occupational medical baseline or surveillance examination, performed by a licensed physician, within the last 24 months. The medical examination includes the following components:

- Personal Medical Questionnaire
- Occupational Exposure History
- Physical Examination
- Vision Testing
- Spirometry
- Audiometry
- Blood Chemistry Panel (e.g., SMAC-20)
- Complete Blood Count with Differential
- Urinalysis
- Chest X-Ray (every two years at a minimum)
- Electrocardiogram (at physician's discretion)

Examinations are required upon hiring, termination, and exposure to substances at or above the PEL.

Results of the examinations are communicated directly from the physician to the employee. Medical records for Equity's employees are kept by the Company and the employee

## Monitoring Requirements

Monitoring is to be conducted by the Site Supervisor, or his/her designee. Copies of monitoring results and calibration logs will be filed with the HASP.

Monitoring is designed to assess exposure to employees during site activities, and to determine if PPE is required and adequate to assure protection. Because investigation and remediation activities at hazardous waste sites are of an inconsistent nature, it is not possible to assign a monitoring protocol that excludes, or is not directly dependent upon, professional judgment in determining when monitoring is required to assess exposure. Thus, the following generic protocol must be followed at a minimum, and should be modified to be more conservative (e.g., require more monitoring) if deemed necessary by the Site Supervisor or HSO. Under no conditions will the required frequency be decreased.

At a minimum, air monitoring will be conducted before and during each task or activities for which air monitoring has been designated. If airborne concentrations of contaminants reach action levels based on observations with the direct reading instruments, then the appropriate PPE upgrade or work stoppage order will be enforced by the Site Supervisor. In case a work stoppage order is given, the area must be cleared of all personnel immediately.

The use of action levels and the basis for the selection of monitoring equipment is explained as follows:

### **Action levels determine:**

- (1) the PPE to be used by site workers
- (2) their ability to remain and work in the exclusion zone

### **The selection of the specified monitoring equipment is based on**

- (1) the nature of the contaminants
- (2) the likely concentrations of the contaminants
- (3) the probable duration of exposure
- (4) the relative sensitivity of the monitoring equipment to the specific contaminants

The following summarizes the calibration requirements for the air monitoring instruments used at the site:

| <u>Instrument</u>                  | <u>Calibration Frequency</u> |
|------------------------------------|------------------------------|
| PID: Mini RAE-3000 (or equivalent) | Beginning of each work shift |

### Air Monitoring and Contaminant Action Levels

| Task No.(s) | Location   | Contaminant      | Monitoring Equipment | Monitoring Frequency                      | Action Level Concentration |                                           |
|-------------|------------|------------------|----------------------|-------------------------------------------|----------------------------|-------------------------------------------|
|             |            |                  |                      |                                           | Mandatory Respirator Use   | Mandatory Work Stoppage                   |
| 1,2,3       | Work Areas | Volatile Organic | PID: Mini-Rae        | Periodically during all tasks/activities. | NA                         | 10 ppm above background in breathing zone |

PID = Photoionization Detector (e.g., Multi-Rae, Mini-Rae, HNU, TIP, OVM)

FID = Flame Ionization Detector (e.g., OVA)

LEL-O<sub>2</sub> = Explosivity and Oxygen Meter

Name(s) of individual(s) responsible for performing the monitoring, and certifying the results:

All Equity personnel

Type, make and model of instruments used: Mini-Rae 3000 (or equivalent) PID Gas Monitor

Method and frequency of calibration:

- 100 ppm isobutylene-calibration gas. Calibrated prior to each day's use according to manufacturer's instruction.
- The calibration of all radiation survey instrumentation will be conducted using calibration standards traceable to the National Bureau of Standards, All instruments used for surveys will be calibrated every six months and after instrument repair when required. All instrument calibrations will be performed by the original manufacturer or a qualified vendor. Instruments will be response checked to a known source of radiation prior to and after field use.

## Procedures for Handling Anticipated Wastes

### Waste Generation

Anticipated: Yes X No     

Types: Liquid      X Solid      X Sludge      Gas     

Quantity: Expected volume of each type: Field determined

This project      will X will not generate hazardous wastes. These wastes will be:  
     stored      treated  
     transported      manifested in accordance with NYS and federal regulations.

**Any soil and/or groundwater produced from sampling activities will remain onsite.**

Packaging requirements for waste material:

---

---

---

---

## Spill Prevention and Response

Potentially hazardous spill situations can be mitigated by using containment devices and materials in work areas. If site conditions are suitable, earthen berms will be constructed around specific areas. If site conditions are not suitable for this, or the potential spill is smaller, barriers will be constructed with sorbent materials such as “speedi-dry”, sorbent booms and/or straw bales. Dikes and berms will also be used to divert stormwater run-on and run-off away from critical zones.

Because a spill cleanup must be conducted under crisis conditions, it is important that the methods used for dealing with a spill be thought out beforehand. However, the steps followed cannot be inflexible, because no two spills are identical. Factors that will be assessed in the event of any and all spills include:

1. The volume of the hazardous substance released and the rate of release.
2. The nature of the spill material.
3. What danger exists to personnel in the immediate area.
4. Nature of damage and possibilities of repair.
5. If the transfer of material to an alternate containment is advisable.
6. Feasibility of the construction of a containment dike.
7. Nature of spill area.
8. Whether the spilled substance has reached a watercourse or sewer.
9. Danger of explosion or fire.
10. Equipment and supplies necessary to confine the material and carry out the cleanup.

In most cases, the success of a cleanup operation is dependent upon the time it takes to contain the spill. Therefore, Equity’s first attempt at spill containment will be at the point of discharge. This can often be accomplished by closing valves, reinforcing or repairing damaged containers, moving or changing the position of fallen or ruptured containers, or emptying the container by pumping to a temporary storage or holding vessel. Pumps, suction hoses and containers will be available to recover spilled materials when directed to do so by the Site Supervisor.

Handling and transport of drummed waste always must be conducted in a controlled and safe manner, which will minimize damage to structurally sound drums, repacks and overpacks. If leakage or spillage of waste occurs, the drum must immediately be placed within an overpack unit. Overpack units must be provided at each staging area, at areas of existing drums, and along all site roadways.

| Task/Work Area  | Potential Spill or Discharge   | Equipment, Materials, and Procedures for Spill Cleanup |
|-----------------|--------------------------------|--------------------------------------------------------|
| Soil excavation | Hydraulic fluid from drill rig | Pads/Speedy Dry                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |
|                 |                                |                                                        |

## Emergency Procedures

Potential emergencies that may arise are most likely to be associated with physical hazards from heavy equipment operation and/or lifting and loading of debris. Emergency response will, in most cases, be performed in Level D protection.

Modifications to these emergency procedures may be necessary after the actual site set-up, based on prevailing conditions. Periodic reviews of these procedures will be performed by the Site Supervisor to ensure that they are appropriate for all anticipated emergencies.

### Responsibilities

The Site Supervisor has the authority and responsibility to commit company resources to appropriately respond to an emergency, and to exclude all personnel not directly responding to the emergency.

Prior to beginning work at the site, Equity will designate an employee, usually the Site Supervisor, to be responsible for initiating any emergency response actions. In the event an injury or illness requires more than first aid treatment, the Site Supervisor (or alternate) will accompany the injured person to the hospital, and will remain with the person until release, admittance is decided, or another Equity staff relieves them of this responsibility.

### Evacuation Plan

The basic elements of an emergency evacuation plan include employee training, escape routes, escape procedures, critical operations or equipment, rescue and medical duty assignments, designation of responsible parties, emergency reporting procedures and methods to account for all employees after evacuation.

When appropriate, wind direction will be discussed during the daily safety briefing to all on-site personnel by the Site Supervisor to indicate possible routes of upwind escape. Work-area entrance and exit routes will be planned, and emergency escape routes will be delineated by the Site Supervisor. The discovery of any condition that would suggest the existence of a situation more hazardous than anticipated, will result in the evacuation of the team and a re-evaluation of the hazard and the level of protection required. This re-evaluation will be conducted by appropriate on-site health and safety personnel in coordination with the HSO

In the highly unlikely event that barrels, canisters, or chemical gases or vapors are uncovered during site work, the following procedures shall be followed:

- 1) In the event that barrels, canisters, or any other vessels are encountered during excavation, all work shall immediately cease and all workers to be removed from the area. The Site Supervisor shall be immediately notified, and he/she shall identify vessel contents, handling procedures and storage and disposal techniques prior to starting work.
- 2) In the event that high concentrations of gases or vapors are detected, the following actions will be taken:
  - Remove all workers from the area
  - Monitor gas or vapor concentrations to determine the type of respiratory protection that will be required before workers reenter the area.
- 3) In the highly unlikely event of a major leak of toxic gas, such as might occur if a compressed gas cylinder were ruptured during excavation or drilling, all on-site personnel will be evacuated to a safe distance. The HSO and Emergency services will be contacted immediately and the risk will be assessed prior to restarting work.



## **Training**

Employees will be instructed in the specific aspects of emergency evaluation applicable to the site as part of the site safety meeting prior to the commencement of all on-site activities. On-site refresher or update training is required anytime escape routes or procedures are modified or personnel assignments are changed. During the site safety meeting, all employees will be trained in, and reminded of the location of this plan, the procedures outlined in this plan, and the communication systems and evacuation routes used during an emergency.

On a continuous basis, individual employees should be constantly alert for indicators of potentially hazardous situations, and for signs and symptoms in themselves and others that warn of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency. In the event of any emergency that necessitates an evaluation of the site, on-site personnel will be notified by the use of car horns sounded in regularly spaced, repeated blasts, as detailed in the next section of this procedure. The Site Supervisor will control the site until the appropriate local or state agency representatives arrive, if required. He will also contact the HSO.

## **Alarm Systems Emergency Signals**

The simplest and most effective emergency communication system, in any situation, is direct voice communications. Voice communications will be supplemented anytime voices cannot be clearly perceived above ambient noise levels (e.g., noise from heavy equipment, drilling rigs or backhoes), and anytime a clear line-of-sight cannot be easily maintained among all site personnel because of distance, terrain, or other obstructions. When voice communications must be supplemented, the following emergency signals, using car horns, will be used.

- One Horn Blast: General Warning

One blast is used to signal relatively minor, but important events on site. An example would be a minor chemical spill where there is no immediate damage to life or health, yet personnel working on site should be aware of the situation so unnecessary problems are avoided. If one horn blast is sounded, personnel must stop all activity and equipment on site and await further instruction from the Site Supervisor.

- Two Horn Blasts: Medical Emergency

Two blasts are used to signal a medical emergency where immediate first aid or emergency medical care is required. If two horn blasts are sounded, all first aid and CPR trained personnel should respond, as appropriate. All other activity and equipment should stop, and personnel should await further instructions from the Site Supervisor.

- Three Horn Blasts Followed by One Continuous Blast: Immediate Danger to Life or Health

Three blasts followed by another extended or continuous horn blast signals a situation that could present an immediate danger to the life or health (IDLH) to all employees on site. Examples of possible IDLH situations could include fires, explosions, hazardous chemical spills or releases, hurricanes, tornadoes, blizzards or floods. If three horn blasts followed by a continuous blast are sounded, all activity and equipment must stop, and all personnel must evacuate the site to an appropriately designated site located outside the site gate, or further off site if necessary. (Note: unless otherwise specified, all decontamination procedures must be implemented.) All personnel must be accounted for by the Site Supervisor, and other response actions determined by the Site Supervisor must be followed.

Employees on site will use the “buddy” system (pairs). Buddies should pre-arrange hand signals or other means of emergency communication in case radios cannot be used, or if the radios no longer operate. The following hand signals are suggested:

1. Hand gripping throat: out of air, can’t breathe.
2. Grip partner’s wrist or place both hands around waste: leave area immediately, no debate.
3. Hand on top of head: need assistance.
4. Thumbs up: OK, I’m alright, I understand.
5. Thumbs down: No, negative.

Visual contact will be maintained between employee pairs. Team members will remain in close proximity to each other in order to provide assistance in case of emergencies, and will inform each other of any of the following effects of exposure to site contamination:

- headaches
- dizziness
- blurred vision
- cramps
- irritation of eyes, skin or respiratory tract

If any member of the work crew experiences any adverse symptoms while on site, the entire work crew will immediately stop work and follow the instructions provided by the Site Supervisor.

### **Medical Treatment/First Aid**

Community emergency services (EMS, fire, and police) will be notified immediately if their resources are needed on site. If necessary, the injured or sick party shall be taken to the nearest hospital.

### **Emergency Reporting**

Any incident (other than minor first aid treatment) resulting in injury, illness or property damage will be reported to Equity. An incident investigation will be initiated as soon as emergency conditions are under control. The purpose of this investigation is not to attribute blame but to determine the pertinent facts so that repeat or similar occurrences can be avoided.

The investigations will begin while details are fresh in the mind of all involved. The person administering first aid may be able to start the fact gathering process if the injured are able to speak. Pertinent facts must be determined. Questions beginning with who, what, when, where, and how are usually most effective to discover ways to improve job performance in terms of efficiency, quality of work, as well as safety and health concerns.

**On-Site Evacuation Plan** –A series of repeated blasts is the signal for all Equity personnel and subcontractors to evacuate the site and assemble at:

**To be determined at the beginning of each field event**

The criteria for activating the alarm will be the first sign of any serious problem that requires assistance or evacuation. Should either a fire or explosion occur, all personnel will proceed immediately to the evacuation assembly point and await further instructions. At that time a personnel check will be conducted to determine if anyone is missing, and the local fire and police departments will be called for assistance. Once on site, the acting officer of the fire department and the Site Supervisor will determine if further evacuations are necessary. No Equity personnel will re-enter the site without clearance from the fire/police department and Site Supervisor. Subcontractor

Safety It has been and shall continue to be the policy of Equity that employees of all subcontractors are required to adhere to all applicable company, local, state, and federal safety rules and regulations.

When an infraction of a local, state, federal, or company safety regulation is observed, the Site Supervisor will request verbally that the subcontractor's supervisory personnel correct the infraction immediately. If correction is not made, then the project manager will request in writing that proper corrective action be taken. Subcontractors who continue to ignore proper safety procedures will have payments withheld until compliance is achieved or be terminated.

Subcontractors are required to hold safety meetings for their employees when they are working on Equity projects, and submit documentation of such meetings to the Project Manager. At a minimum they shall have specific safety procedures for proper use of all heavy equipment such as excavators, drilling rigs, etc., on site during the project. Subcontractor employees are required to attend Equity's safety meetings.

# Forms

# Job Safety & Health Protection

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

## **Employers**

All employers must furnish to employees' employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

## **Employees**

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct job site inspections to help ensure compliance with the Act.

## **Inspection**

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

## **Complaint**

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection. If they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

## **Citation**

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period with which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

## **Proposed Penalty**

The Act provides for mandatory penalties against employers of up to \$1,000 for each serious violation and for optional penalties of up to \$1,000 for each non-serious violation. Penalties of up to \$1,000 per day may be proposed for failure to correct violations within the proposed time period. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$10,000 for each such violation.

There are also provisions for central penalties. Any willful violation resulting in death of an employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months or both. A second conviction of an employer doubles the possible term of imprisonment.

## **Voluntary Activity**

While providing penalties for violation, the Act also encourages efforts by labor and management before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort if requested. Also, your local OSHA office can provide considerable help and advice on saving safety and health problems or can refer you to other sources for help such as training.

## **Consultation**

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State of Labor or Health Department or a State University.

---

*Under provisions of Title 29, Code of Federal Regulations, part 1903.2(s)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.*

## HASP Sign-Off Form

INSTRUCTIONS: Site personnel are required to read, understand, and agree to the provision of the plan. Personnel are required to sign this form indicating agreement. The original of this form is maintained by the Project Manager, and becomes part of the permanent site project files upon completion of site work.

**Site Name:** South 5<sup>th</sup> Street

**Location:** 105 South 5th Street, Brooklyn, New York

**Project Name and Number:** 2014074

I have read, understand, and agree to comply with the provisions of this HASP for work activities on this site.

| Name | Signature | Company/Agency | Date |
|------|-----------|----------------|------|
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |
|      |           |                |      |

## Equipment Calibration Log

Operator Name: \_\_\_\_\_ Instrument Notice: \_\_\_\_\_

Signature: \_\_\_\_\_ Serial Number: \_\_\_\_\_

[illegible]

## Sampling Log

Operator Name: \_\_\_\_\_ Instrument Notice: \_\_\_\_\_

Signature:\_\_\_\_\_ Serial Number:\_\_\_\_\_

Was the equipment calibrated? \_\_\_\_\_ Yes \_\_\_\_\_ No

[illegible]



## Heat Stress Monitoring Log

|                                                               |  |  |  |  |  |  |  |
|---------------------------------------------------------------|--|--|--|--|--|--|--|
| Employee Name                                                 |  |  |  |  |  |  |  |
| Start Time                                                    |  |  |  |  |  |  |  |
| <u>Measurement 1</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 2</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 3</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 4</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 5</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 6</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 7</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |
| <u>Measurement 8</u><br>Pulse<br>Work Minutes<br>Rest Minutes |  |  |  |  |  |  |  |

\_\_\_\_\_  
Signature of Site Supervisor (or designee)

\_\_\_\_\_  
Date

**Daily Sign In/Sign Out Form**  
(to be completed on site)

Site Name: South 5<sup>th</sup> Street

Location: South 5<sup>th</sup> St, Brooklyn, New York

| Employee Name | Company Name | Purpose | Time In | Time Out | Date |
|---------------|--------------|---------|---------|----------|------|
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |
|               |              |         |         |          |      |

\_\_\_\_\_  
Signature of Site Supervisor (or designee)

\_\_\_\_\_  
Date

**Daily Safety Meeting Log**  
(to be completed on site)

Site Name                      South 5<sup>th</sup> St.

Location                      South 5<sup>th</sup> St, Brooklyn, New York

Weather                      \_\_\_\_\_

Topics                      \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Employee Names:

Signatures

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_  
Signature of Site Supervisor (or designee)

\_\_\_\_\_  
Date

# ACCIDENT INVESTIGATION REPORT

|                                                                                              |                  |                                                                                                   |     |                  |
|----------------------------------------------------------------------------------------------|------------------|---------------------------------------------------------------------------------------------------|-----|------------------|
| Place Accident Occurred:                                                                     |                  | Name of Person Involved:                                                                          |     |                  |
| Site Location                                                                                |                  | Age                                                                                               | Sex | Job Title        |
|                                                                                              |                  | Yrs in This Job                                                                                   |     | Yrs with Company |
| Date & Time of Incident<br><div> <div>___/___/_____</div> <div>AM</div> <div>PM</div> </div> |                  | Date & Time of Investigation<br><div> <div>___/___/_____</div> <div>AM</div> <div>PM</div> </div> |     |                  |
| Date Incident Reported<br>___/___/___                                                        | Reported to Whom | Investigated By:                                                                                  |     |                  |
| Regulatory Agencies or Insurance Carriers Contacted:                                         |                  | Witness(es):                                                                                      |     |                  |
| Description from injured or witnesses (use reverse side of form for more space):             |                  |                                                                                                   |     |                  |
| <div> <div>Signature</div> <div>Date</div> </div>                                            |                  |                                                                                                   |     |                  |

Select one or more in each column. Don't hesitate to write in your own words (continue on reverse side, if necessary).

When completing the following task:

- ☐ Operating (what machine) \_\_\_\_\_  
☐ Using (what tool) \_\_\_\_\_  
☐ Handling (what material) \_\_\_\_\_  
☐ Maintenance or repair (of what) \_\_\_\_\_  
☐ Office or sales task \_\_\_\_\_  
☐ Other -- Provide details \_\_\_\_\_

The following occurred:

- ☐ Amputation (total or partial)
- ☐ Burn (thermal)
- ☐ Burn (chemical)
- ☐ Electric shock
- ☐ Concussion/unconscious
- ☐ Crushing injury (contusion, crush, bruise) -- intact skin
- ☐ Cut, laceration, puncture, abrasion
- ☐ Fracture or dislocation
- ☐ Sprain/strain
- ☐ Cumulative trauma
- ☐ Occupational illness or disease
- ☐ Internal injuries
- ☐ None -- Near accident
- ☐ Other -- Provide details
- ☐ Respiratory

To the (explain details):

- ☐ Head, face, neck \_\_\_\_\_
- ☐ Eye \_\_\_\_\_
- ☐ Trunk, abdomen \_\_\_\_\_
- ☐ Back (upper, lower) \_\_\_\_\_
- ☐ Arm, shoulder \_\_\_\_\_
- ☐ Fingers \_\_\_\_\_
- ☐ Leg, hip, knee \_\_\_\_\_
- ☐ Ankle, foot \_\_\_\_\_
- ☐ Toes \_\_\_\_\_
- ☐ Internal Injuries \_\_\_\_\_
- ☐ Body System: \_\_\_\_\_
- ☐ Circulatory \_\_\_\_\_
- ☐ Digestive \_\_\_\_\_
- ☐ Musculoskeletal \_\_\_\_\_
- ☐ Nervous \_\_\_\_\_
- ☐ Other \_\_\_\_\_
- ☐ Other (specify) \_\_\_\_\_

**Person was, or got:**

- ☐ Struck against (not including falls) \_\_\_\_\_
- ☐ Struck by \_\_\_\_\_
- ☐ Fell from (from a higher level) \_\_\_\_\_
- ☐ Slipped, tripped, fell on (in the same level) \_\_\_\_\_
- ☐ Foreign body in eye \_\_\_\_\_
- ☐ Contacted electrical energy from \_\_\_\_\_
- ☐ Exposure to (substance) \_\_\_\_\_  
                                from inhalation \_\_\_\_\_  
                                ingestion \_\_\_\_\_  
                                skin absorption \_\_\_\_\_
- ☐ Vehicle accident \_\_\_\_\_
- ☐ Caught in, under or between \_\_\_\_\_
- ☐ Repetitive \_\_\_\_\_
- ☐ Other \_\_\_\_\_

**While (taking what position) Where (or What):**

- ☐ Carrying
- ☐ Climbing
- ☐ Bending
- ☐ Driving
- ☐ Jumping
- ☐ Kneeling
- ☐ Lifting - below waist, give weight)
- ☐ Lifting - above waist, give weight)
- ☐ Pulling
- ☐ Pushing
- ☐ Reaching or stretching
- ☐ Riding
- ☐ Running
- ☐ Sitting
- ☐ Standing
- ☐ Throwing
- ☐ Twisting or turning
- ☐ Walking
- ☐ Other

**Medical Treatment (check as many as apply)**

- ☐ The injured employee was able to return to work the same day.
- ☐ The injured employee was sent home
- ☐ The injured employee was sent to a doctor/ clinic; list the doctor/clinic name, address, and phone: \_\_\_\_\_

☐The employee was hospitalized.  
List name and address of hospital:

Attending physician:\_\_\_\_\_

### What conditions contributed

- ☐Awkward job procedure
- ☐Inadequate guard/safety device
- ☐Inadequate warning/labeling system
- ☐Fire/explosion hazard
- ☐Not secured against moving
- ☐Poor housekeeping
- ☐Protruding object
- ☐Close clearance/congestion
- ☐Hazardous arrangement/storage
- ☐Defective tools/equipment
- ☐Inadequate ventilation
- ☐Atmospheric condition: gases,

### What unsafe procedures contributed

- ☐ Operating without training/authority
- ☐ Failure to follow proper procedure
- ☐ Failure to secure
- ☐ Operating at unsafe speed
- ☐ Failure to warn/signal
- ☐ Congestion
- ☐ Used defective equipment
- ☐ Used equipment improperly/unsafely
- ☐ Improper loading or placement
- ☐ Horseplay/distraction
- ☐ Improper protective equipment
- ☐ Improper lifting or carrying

**The underlying causes of the incident are:**

- ☐ Unaware of job hazards
- ☐ Inattention to hazard
- ☐ Unaware of how to avoid incident
- ☐ Not enough time to act
- ☐ Person motivated to use unsafe procedure
- ☐ Emotional/mental/physical stress
- ☐ Equipment failed to perform as expected
- ☐ Intoxicant/drugs
- ☐ Failure to report/correct unsafe condition
- ☐ Illness/medical condition
- ☐ Work procedure not ergonomically correct
- ☐ Substandard design

**Classification (check as many as apply)**

- Classification (check as many as apply)
- ☐ Fatality
  - ☐ Medical treatment other than First Aid
  - ☐ Occupation illness or disease
  - ☐ First Aid
  - ☐ Environmental Release
  - ☐ Property Damage
  - ☐ Near-accident

dusts, fumes, vapors  
☐ Repetitive motion  
☐ Illumination/noise hazard  
☐ Other

☐ Taking unsafe or awkward position  
☐ Servicing moving equipment  
☐ Other

☐ Other

## ACCIDENT DESCRIPTION (continued):

What steps have already been taken to prevent similar incidents? \_\_\_\_\_

---

---

---

What else can be done (engineering controls, training, enforcement, process changes) to eliminate the hazard? \_\_\_\_\_

---

---

\_\_\_\_\_  
Site Supervisor Signature Date

**Health and Safety Review:** Is proposed action appropriate? Yes ☐ No ☐ Comments \_\_\_\_\_

---

---

---

---

\_\_\_\_\_  
HSO Signature Date

### VEHICLE ACCIDENT REPORT

EMPLOYEE NAME: \_\_\_\_\_ DRV LIC NO.: \_\_\_\_\_

COMPANY ADDRESS: \_\_\_\_\_ INSURANCE COMPANY \_\_\_\_\_

POLICY NO.: \_\_\_\_\_

### DESCRIPTION OF ACCIDENT

DATE: \_\_\_\_\_ TIME: \_\_\_\_\_ SPEED LIMIT \_\_\_\_\_:

LOCATION: \_\_\_\_\_

DIRECTION OF TRAVEL: \_\_\_\_\_

HOW DID IT HAPPEN? \_\_\_\_\_

USE SPACE BELOW TO INDICATE VEHICLE PATHS - INDICATE NORTH BY ARROW

### POLICE REPORT

NAME OF OFFICER: \_\_\_\_\_ BADGE #: \_\_\_\_\_

DEPARTMENT: \_\_\_\_\_ LOCATION: \_\_\_\_\_

SUMMONS ISSUED? Y [ ] N [ ] TO WHOM? \_\_\_\_\_

### YOUR VEHICLE

YEAR/MAKE: \_\_\_\_\_ REGIST #: \_\_\_\_\_

DRIVEN BY: \_\_\_\_\_ AGE: \_\_\_\_\_ TEL #: \_\_\_\_\_

ADDRESS: \_\_\_\_\_ CITY: \_\_\_\_\_ STATE: \_\_\_\_\_

NATURE OF DAMAGE: \_\_\_\_\_

**OTHER DRIVER**

(continue below for additional drivers and witnesses)

NAME: \_\_\_\_\_

DRV LIC NO.: \_\_\_\_\_

ADDRESS: \_\_\_\_\_

VEHICLE REGISTRATION: \_\_\_\_\_

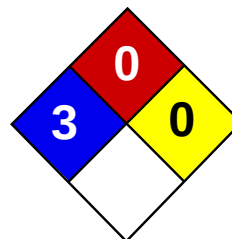
\_\_\_\_\_

INSURANCE COMPANY \_\_\_\_\_

POLICY NO.: \_\_\_\_\_

## **Safety Data Sheets**





|                     |   |
|---------------------|---|
| Health              | 3 |
| Fire                | 0 |
| Reactivity          | 0 |
| Personal Protection |   |

## Material Safety Data Sheet

### Mercury MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Mercury

**Catalog Codes:** SLM3505, SLM1363

**CAS#:** 7439-97-6

**RTECS:** OV4550000

**TSCA:** TSCA 8(b) inventory: Mercury

**CI#:** Not applicable.

**Synonym:** Quick Silver; Colloidal Mercury; Metallic Mercury; Liquid Silver; Hydragryum

**Chemical Name:** Mercury

**Chemical Formula:** Hg

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

#### Section 2: Composition and Information on Ingredients

##### Composition:

| Name    | CAS #     | % by Weight |
|---------|-----------|-------------|
| Mercury | 7439-97-6 | 100         |

**Toxicological Data on Ingredients:** Mercury LD50: Not available. LC50: Not available.

#### Section 3: Hazards Identification

##### Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

##### Potential Chronic Health Effects:

Hazardous in case of skin contact (permeator). **CARCINOGENIC EFFECTS:** Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance may be toxic to blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation.

Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

#### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

**Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:** Not applicable.

**Special Remarks on Fire Hazards:**

When thrown into mercury vapor, boron phosphodiiodide ignites at once. Flame forms with chlorine jet over mercury surface at 200 deg to 300 deg C. Mercury undergoes hazardous reactions in the presence of heat and sparks or ignition.

**Special Remarks on Explosion Hazards:**

A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium. CHLORINE DIOXIDE & LIQUID HG, WHEN MIXED, EXPLODE VIOLENTLY. Mercury and Ammonia can produce an

explosive compound. A mixture of the dry carbonyl and oxygen will explode on vigorous shaking with mercury. Methyl azide in the presence of mercury was shown to be potentially explosive.

## Section 6: Accidental Release Measures

**Small Spill:** Absorb with an inert material and put the spilled material in an appropriate waste disposal.

**Large Spill:**

Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**

Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals.

**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 25°C (77°F).

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

**Personal Protection:**

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

**Personal Protection in Case of a Large Spill:**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**

TWA: 0.025 from ACGIH (TLV) [United States] SKIN TWA: 0.05 CEIL: 0.1 (mg/m<sup>3</sup>) from OSHA (PEL) [United States]  
Inhalation TWA: 0.025 (mg/m<sup>3</sup>) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid. (Heavy liquid)

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 200.59 g/mole

**Color:** Silver-white

**pH (1% soln/water):** Not available.

**Boiling Point:** 356.73°C (674.1°F)

**Melting Point:** -38.87°C (-38°F)

**Critical Temperature:** 1462°C (2663.6°F)

**Specific Gravity:** 13.55 (Water = 1)

**Vapor Pressure:** Not available.

**Vapor Density:** 6.93 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Very slightly soluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

**Incompatibility with various substances:** Reactive with oxidizing agents, metals.

**Corrosivity:** Non-corrosive in presence of glass.

### Special Remarks on Reactivity:

Ground mixtures of sodium carbide and mercury, aluminum, lead, or iron can react vigorously. A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium. Incompatible with boron diiodophosphide; ethylene oxide; metal oxides, metals(aluminum, potassium, lithium, sodium, rubidium); methyl azide; methylsilane, oxygen; oxidants(bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonylnickel, nitromethane, silver perchlorate, chlorates, sulfuric acid, nitrates,); tetracarbonylnickel, oxygen, acetylinic compounds, ammonia, ethylene oxide, methylsilane, calcium,

### Special Remarks on Corrosivity:

The high mobility and tendency to dispersion exhibited by mercury, and the ease with which it forms alloys (amalgam) with many laboratory and electrical contact metals, can cause severe corrosion problems in laboratories. Special precautions: Mercury can attack copper and copper alloy materials.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

### Toxicity to Animals:

LD50: Not available. LC50: Not available.

### Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS).

### Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator).

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**

May affect genetic material. May cause cancer based on animal data. Passes through the placental barrier in animal. May cause adverse reproductive effects(paternal effects- spermatogenesis; effects on fertility - fetotoxicity, post-implantation mortality), and birth defects.

**Special Remarks on other Toxic Effects on Humans:**

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

## Section 14: Transport Information

**DOT Classification:** Class 8: Corrosive material

**Identification:** : Mercury UNNA: 2809 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Mercury California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Mercury Connecticut hazardous material survey.: Mercury Illinois toxic substances disclosure to employee act: Mercury Illinois chemical safety act: Mercury New York acutely hazardous substances: Mercury Rhode Island RTK hazardous substances: Mercury Pennsylvania RTK: Mercury Minnesota: Mercury Massachusetts RTK: Mercury New Jersey: Mercury New Jersey spill list: Mercury Louisiana spill reporting: Mercury California Director's List of Hazardous Substances.: Mercury TSCA 8(b) inventory: Mercury SARA 313 toxic chemical notification and release reporting: Mercury CERCLA: Hazardous substances.: Mercury: 1 lbs. (0.4536 kg)

**Other Regulations:**

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

**Other Classifications:**

**WHMIS (Canada):**

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

**DSCL (EEC):**

R23- Toxic by inhalation. R33- Danger of cumulative effects. R38- Irritating to skin. R41- Risk of serious damage to eyes. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S2- Keep out of the

reach of children. S7- Keep container tightly closed. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S60- This material and its container must be disposed of as hazardous waste. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:**

**National Fire Protection Association (U.S.A.):**

**Health:** 3

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

## Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:22 PM

**Last Updated:** 05/21/2013 12:00 PM

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall ScienceLab.com be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if ScienceLab.com has been advised of the possibility of such damages.*

SUPELCO INC -- 48499, INDENO (1,2,3-CD) PYRENE 10MG -- 6810-00N032522

===== Product Identification =====

Product ID:48499, INDENO (1,2,3-CD) PYRENE 10MG

MSDS Date:06/06/1985

FSC:6810

NIIN:00N032522

MSDS Number: BNSSK

=== Responsible Party ===

Company Name:SUPELCO INC

Address:SUPELCO PARK

City:BELLEFONTE

State:PA

ZIP:16823-0048

Country:US

Info Phone Num:814-359-3441

Emergency Phone Num:814-359-3441

CAGE:54968

=== Contractor Identification ===

Company Name:SIGMA-ALDRICH INC.

Address:3050 SPRUCE STREET

Box:14508

City:ST. LOUIS

State:MO

ZIP:63103

Country:US

Phone:314-771-5765/414-273-3850X5996

CAGE:54968

===== Composition/Information on Ingredients =====

Ingred Name:INDENO 1,2,3-CD PYRENE

CAS:193-39-5

RTECS #:NK9300000

EPA Rpt Qty:100 LBS

DOT Rpt Qty:100 LBS

===== Hazards Identification =====

LD50 LC50 Mixture:NONE SPECIFIED BY MANUFACTURER.

Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES

Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO

Health Hazards Acute and Chronic:REPORTED ANIMAL CARCINOGEN.

Explanation of Carcinogenicity:INDENO(1,2,3-CD) PYRENE: GROUP 2B(IARC),  
ANTICIPATED TO BE CARCINOGEN (NTP).

Effects of Overexposure:NONE SPECIFIED BY MANUFACTURER.

Medical Cond Aggravated by Exposure:NONE SPECIFIED BY MANUFACTURER.

===== First Aid Measures =====

First Aid:EYES: FLUSH WITH WATER FOR AT LEAST 15 MIN. SKIN: FLUSH WITH  
LARGE VOLUMES OF WATER. REMOVE CONTAMINATED CLOTHING. INHAL: MOVE  
TO FRESH AIR. IF BREATHING STOPS, GIVE ARTF RESP. INGEST: IMMED  
CONTACT A PHYSICIAN.

===== Fire Fighting Measures =====

Flash Point:400F,204C

Extinguishing Media:CO2, DRY CHEMICAL.

Fire Fighting Procedures:WEAR NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT .

===== Accidental Release Measures =====

Spill Release Procedures:SWEEP UP MATERIAL. AVOID GENERATING DUST.

Neutralizing Agent:NONE SPECIFIED BY MANUFACTURER.

===== Handling and Storage =====

Handling and Storage Precautions:STORE IN SEALED CONTR IN COOL, DRY LOCATION. KEEP AWAY FROM OXIDIZERS. STORE IN DRY, WELL VENTILATED AREA.

Other Precautions:REPORTED CANCER HAZARD. AVOID EYE OR SKIN CONTACT.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT .

Ventilation:USE ONLY IN EXHAUST HOOD.

Protective Gloves:NEOPRENE GLOVES.

Eye Protection:CHEMICAL WORKERS GOGGLES .

Work Hygienic Practices:NONE SPECIFIED BY MANUFACTURER.

Supplemental Safety and Health  
NONE SPECIFIED BY MANUFACTURER.

===== Physical/Chemical Properties =====

HCC:T6

Melt/Freeze Pt:M.P/F.P Text:324F,162C

Vapor Pres:0.10

Appearance and Odor:YELLOW CRYSTALS

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
OXIDIZING AGENTS. METALLIC SODIUM & POTASSIUM.

===== Disposal Considerations =====

Waste Disposal Methods:COMPLY WITH ALL APPLICABLE FEDERAL, STATE, OR LOCAL REGULATIONS.

Disclaimer (provided with this information by the compiling agencies):  
This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever, expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.



# Material Safety Data Sheet

## Chrysene, 98%

ACC# 95251

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Chrysene, 98%**Catalog Numbers:** AC224140000, AC224140010, AC224140050, AC224145000, NC9381297, XXAC22414-300G**Synonyms:** 1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.**Company Identification:**

Fisher Scientific  
 1 Reagent Lane  
 Fair Lawn, NJ 07410

**For information, call:** 201-796-7100**Emergency Number:** 201-796-7100**For CHEMTREC assistance, call:** 800-424-9300**For International CHEMTREC assistance, call:** 703-527-3887

### Section 2 - Composition, Information on Ingredients

| CAS#     | Chemical Name | Percent | EINECS/ELINCS |
|----------|---------------|---------|---------------|
| 218-01-9 | Chrysene      | 98      | 205-923-4     |

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: very light beige solid.

**Caution!** May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.**Target Organs:** Liver, skin.**Potential Health Effects****Eye:** May cause eye irritation.**Skin:** May cause skin irritation.**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea.**Inhalation:** May cause respiratory tract irritation.**Chronic:** May cause cancer according to animal studies.

### Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.**Skin:** Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or

water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

**Extinguishing Media:** Use water spray, dry chemical, carbon dioxide, or chemical foam.

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: ; Flammability: 1; Instability:

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Wash thoroughly after handling. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.

**Storage:** Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

### Exposure Limits

| Chemical Name | ACGIH                                                                                   | NIOSH                                                                                                                                                   | OSHA - Final PELs                                                                     |
|---------------|-----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Chrysene      | 0.2 mg/m <sup>3</sup> TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m <sup>3</sup> TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m <sup>3</sup> IDLH (listed under Coal tar pitches). | 0.2 mg/m <sup>3</sup> TWA (benzene soluble fraction) (listed under Coal tar pitches). |

**OSHA Vacated PELs:** Chrysene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** very light beige

**Odor:** Not available.

**pH:** Not available.

**Vapor Pressure:** Not available.

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not available.

**Boiling Point:** 448 deg C @ 760 mm Hg

**Freezing / Melting Point:** 250-255 deg C

**Decomposition Temperature:** Not available.

**Solubility:** insoluble

**Specific Gravity / Density:** Not available.

**Molecular Formula:** C<sub>18</sub>H<sub>12</sub>

**Molecular Weight:** 228.29

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Dust generation.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 218-01-9: GC0700000

**LD50 / LC50:**

Not available.

**Carcinogenicity:**

CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed animal carcinogen with unknown relevance to humans
- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).

- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No information found

**Teratogenicity:** No information found

**Reproductive Effects:** No information found

**Mutagenicity:** Chrysene was mutagenic to *S. Typhimurium* in the presence of an exogenous metabolic system.

**Neurotoxicity:** No information found

**Other Studies:**

## Section 12 - Ecological Information

**Ecotoxicity:** Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified Fish toxicity : LC50 (96hr) *Neaethes arenacedentata* >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal threshold concentration (24hr) *Daphnia Magna* 0,7æg/l.(\* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr *Daphnia Magna* log bioconcentration factor 3.7845 (\*)

**Environmental:** Degradation studies : biodegraded by white rot fungus (Proc.Annu.Meet.Am.Wood-Preserv.Assoc.1989) May be utilised by axenic cultures of microorganisms e.g. *Pseudomonas pancimobilis* EPA505, which may have novel degradative systems(Mueller,J.G. et al ppl.Environ.Microbiol.1990; Mueller, J.G. et al Environ.Sci.Technol.1991).

**Physical:** Not found.

**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:**

CAS# 218-01-9: waste number U050.

## Section 14 - Transport Information

|                       | US DOT                                              | Canada TDG                |
|-----------------------|-----------------------------------------------------|---------------------------|
| <b>Shipping Name:</b> | ENVIRONMENTALLY HAZARDOUS SUBSTANCES, SOLID, N.O.S. | No information available. |
| <b>Hazard Class:</b>  | 9                                                   |                           |
| <b>UN Number:</b>     | UN3077                                              |                           |
| <b>Packing Group:</b> | III                                                 |                           |

## Section 15 - Regulatory Information

### US FEDERAL

**TSCA**

CAS# 218-01-9 is listed on the TSCA inventory.

**Health & Safety Reporting List**

None of the chemicals are on the Health & Safety Reporting List.

**Chemical Test Rules**

None of the chemicals in this product are under a Chemical Test Rule.

**Section 12b**

None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

**CERCLA Hazardous Substances and corresponding RQs**

CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

**SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

**Section 313**

This material contains Chrysene (CAS# 218-01-9, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

**Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

**Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

**STATE**

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

**California Prop 65****The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:**

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

**European / International Regulations****European Labeling in Accordance with EC Directives****Hazard Symbols:**

T

**Risk Phrases:**

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

**Safety Phrases:**

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

**WGK (Water Danger / Protection)**

CAS# 218-01-9: No information available.

**Canada - DSL/NDSL**

CAS# 218-01-9 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.

|                                            |
|--------------------------------------------|
| <b>Section 16 - Additional Information</b> |
|--------------------------------------------|

**MSDS Creation Date:** 6/30/1999

**Revision #5 Date:** 3/15/2007

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

## CHEM SERVICE INC -- F74 BENZO/B/FLUORANTHENE -- 6550-00F037517

## ===== Product Identification =====

Product ID:F74 BENZO/B/FLUORANTHENE  
MSDS Date:09/11/1990  
FSC:6550  
NIIN:00F037517  
MSDS Number: BWJGM  
=== Responsible Party ===  
Company Name:CHEM SERVICE INC  
Address:660 TOWER LN  
Box:3108  
City:WEST CHESTER  
State:PA  
ZIP:19381-3108  
Country:US  
Info Phone Num:215-692-3026/800-452-9994  
Emergency Phone Num:215-692-3026/800-452-9994  
CAGE:84898

## === Contractor Identification ===

Company Name:CHEM SERVICE INC  
Box:3108  
City:WEST CHESTER  
State:PA  
ZIP:19381  
Country:US  
Phone:215-692-3026  
CAGE:84898  
Company Name:CHEM SERVICE, INC  
Address:660 TOWER LN  
Box:599  
City:WEST CHESTER  
State:PA  
ZIP:19301-9650  
Country:US  
Phone: 610-692-3026  
CAGE:8Y898

## ===== Composition/Information on Ingredients =====

Ingred Name:BENZO (B) FLUORANTHENE (SUSPECTED CARCINOGEN BY NTP, IARC  
GROUP 2B) \*94-4\*  
CAS:205-99-2  
RTECS #:DF6350000  
Other REC Limits:A2 CARCINOGEN  
EPA Rpt Qty:1 LB  
DOT Rpt Qty:1 LB

## ===== Hazards Identification =====

LD50 LC50 Mixture:ORAL LD50 (RAT/MOUSE): 72 MG/KG  
Routes of Entry: Inhalation:NO Skin:NO Ingestion:NO  
Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO  
Explanation of Carcinogenicity:SEE INGREDIENTS

## ===== First Aid Measures =====

First Aid:EYES: FLUSH W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR

15-20 MINS. IF NOT BURNED, WASH W/SOAP & WATER TO CLEANSE.  
 INHALATION: REMOVE TO FRESH AIR. GIVE CPR/OXYGEN IF NEEDED. KEEP  
 WARM & QUIET. IN GESTION: DON'T GIVE LIQUIDS/INDUCE VOMITING IF  
 UNCONSCIOUS/CONVULSING. IF VOMITING OCCURS, WATCH CLOSELY TO AVOID  
 AIRWAY OBSTRUCTION. OBTAIN MEDICAL ATTENTION IN ALL CASES.

===== Fire Fighting Measures =====

Extinguishing Media:CO2, DRY CHEMICAL POWDER/SPRAY.

===== Accidental Release Measures =====

Spill Release Procedures:EVACUATE AREA. WEAR APPROPRIATE OSHA  
 REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR  
 MATERIAL. SWEEP UP & PLACE IN APPROPRIATE CONTAINER/HOLD FOR  
 DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

===== Handling and Storage =====

Handling and Storage Precautions:STORE IN A COOL DRY PLACE ONLY  
 W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. FOR LABORATORY USE  
 ONLY.

Other Precautions:AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE  
 VAPORS. CONTACT LENSES SHOULDN'T BE WORN IN THE LABORATORY. ALL  
 CHEMICALS SHOULD BE CONSIDERED HAZARDOUS. AVOID DIRECT PHYSICAL  
 CONTACT.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:WEAR APPROPRIATE OSHA/MSHA APPROVED SAFETY  
 EQUIPMENT.

Ventilation:CHEMICAL SHOULD BE HANDLED ONLY IN A HOOD.

Eye Protection:EYE SHIELDS

Work Hygienic Practices:REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE  
 REUSE.

Supplemental Safety and Health

===== Physical/Chemical Properties =====

Melt/Freeze Pt:M.P/F.P Text:334.4F

Appearance and Odor:CRYSTALLINE SOLID

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES

===== Disposal Considerations =====

Waste Disposal Methods:BURN IN A CHEMICAL INCINERATOR EQUIPPED W/AN  
 AFTERBURNER & SCRUBBER IAW/FEDERAL, STATE & LOCAL REGULATIONS.

Disclaimer (provided with this information by the compiling agencies):  
 This information is formulated for use by elements of the Department  
 of Defense. The United States of America in no manner whatsoever,  
 expressly or implied, warrants this information to be accurate and  
 disclaims all liability for its use. Any person utilizing this  
 document should seek competent professional advice to verify and  
 assume responsibility for the suitability of this information to their  
 particular situation.



# Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Benzo[a]pyrene, 98%

**Catalog Numbers:** AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000

**Synonyms:** 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01

**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

| CAS#    | Chemical Name  | Percent | EINECS/ELINCS |
|---------|----------------|---------|---------------|
| 50-32-8 | Benzo[a]pyrene | >96     | 200-028-5     |

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: yellow to brown powder.

**Danger!** May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.

**Target Organs:** Reproductive system, skin.

### Potential Health Effects

**Eye:** May cause eye irritation.

**Skin:** May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

**Ingestion:** May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

**Inhalation:** May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

**Chronic:** May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

**Extinguishing Media:** Use water spray, dry chemical, carbon dioxide, or appropriate foam.

**Flash Point:** Not available.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

**Storage:** Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

| Chemical Name  | ACGIH                                                                                   | NIOSH                                                                                                                                         | OSHA - Final PELs                                                                        |
|----------------|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| Benzo[a]pyrene | 0.2 mg/m <sup>3</sup> TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m <sup>3</sup> TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m <sup>3</sup> IDLH (listed under Coal tar | 0.2 mg/m <sup>3</sup> TWA (as benzene soluble fraction) (listed under Coal tar pitches). |

|  |           |  |
|--|-----------|--|
|  | pitches). |  |
|--|-----------|--|

**OSHA Vacated PELs:** Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

|                                              |
|----------------------------------------------|
| Section 9 - Physical and Chemical Properties |
|----------------------------------------------|

**Physical State:** Powder

**Appearance:** yellow to brown

**Odor:** faint aromatic odor

**pH:** Not available.

**Vapor Pressure:** Not available.

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not available.

**Boiling Point:** 495 deg C @ 760 mm Hg

**Freezing / Melting Point:** 175 - 179 deg C

**Decomposition Temperature:** Not available.

**Solubility:** 1.60x10<sup>-3</sup> mg/l @25°C

**Specific Gravity / Density:** Not available.

**Molecular Formula:** C<sub>20</sub>H<sub>12</sub>

**Molecular Weight:** 252.31

|                                       |
|---------------------------------------|
| Section 10 - Stability and Reactivity |
|---------------------------------------|

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Dust generation.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

|                                        |
|----------------------------------------|
| Section 11 - Toxicological Information |
|----------------------------------------|

**RTECS#:**

**CAS#** 50-32-8: DJ3675000

**LD50 / LC50:**

Not available.

**Carcinogenicity:**

CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen

- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No information found

**Teratogenicity:** No information found

**Reproductive Effects:** Adverse reproductive effects have occurred in experimental animals.

**Mutagenicity:** Mutagenic effects have occurred in humans. Mutagenic effects have occurred in experimental animals.

**Neurotoxicity:** No information found

**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:**

CAS# 50-32-8: waste number U022.

## Section 14 - Transport Information

|                       | US DOT                               | Canada TDG                                                 |
|-----------------------|--------------------------------------|------------------------------------------------------------|
| <b>Shipping Name:</b> | NOT REGULATED FOR DOMESTIC TRANSPORT | ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene) |
| <b>Hazard Class:</b>  |                                      | 9                                                          |
| <b>UN Number:</b>     |                                      | UN3077                                                     |
| <b>Packing Group:</b> |                                      | III                                                        |

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 50-32-8 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

#### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

### **CERCLA Hazardous Substances and corresponding RQs**

CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

### **SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

### **SARA Codes**

CAS # 50-32-8: immediate, delayed.

### **Section 313**

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

### **Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

### **Clean Water Act:**

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

### **OSHA:**

None of the chemicals in this product are considered highly hazardous by OSHA.

### **STATE**

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

### **California Prop 65**

### **The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:**

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

## **European / International Regulations**

### **European Labeling in Accordance with EC Directives**

### **Hazard Symbols:**

T N

### **Risk Phrases:**

R 43 May cause sensitization by skin contact.

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

### **Safety Phrases:**

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

### **WGK (Water Danger/Protection)**

CAS# 50-32-8: No information available.

### **Canada - DSL/NDSL**

CAS# 50-32-8 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

|                                            |
|--------------------------------------------|
| <b>Section 16 - Additional Information</b> |
|--------------------------------------------|

**MSDS Creation Date:** 9/02/1997

**Revision # 7 Date:** 6/30/2006

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

## SUPELCO,INC. -- BENZO(A)ANTHRACENE 0.1G,48563 -- 6810-00N010656

## ===== Product Identification =====

Product ID:BENZO(A)ANTHRACENE 0.1G,48563

MSDS Date:05/16/1985

FSC:6810

NIIN:00N010656

MSDS Number: BHYRL

=== Responsible Party ===

Company Name:SUPELCO,INC.

Address:SUPELCO PARK

City:BELLEFONTE

State:PA

ZIP:16823-0048

Info Phone Num: 814-359-3441

Emergency Phone Num: 814-359-3441

CAGE:HO582

=== Contractor Identification ===

Company Name:SIGMA-ALDRICH INC.

Address:3050 SPRUCE STREET

Box:14508

City:ST. LOUIS

State:MO

ZIP:63103

Country:US

Phone:314-771-5765/414-273-3850X5996

CAGE:54968

Company Name:SUPELCO,INC.

Address:SUPELCO PARK

Box:City:BELLEFONTE

State:PA

ZIP:16823-0048

Phone: 814-359-3441

CAGE:HO582

## ===== Composition/Information on Ingredients =====

Ingred Name:BENZ A ANTHRACENE (SARA III)

CAS:56-55-3

RTECS #:CV9275000

Other REC Limits:N/K

ACGIH TLV:A2 ; 9394

EPA Rpt Qty:10 LBS

DOT Rpt Qty:10 LBS

## ===== Hazards Identification =====

Routes of Entry: Inhalation:NO Skin:NO Ingestion:NO

Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO

Health Hazards Acute and Chronic:SEE SIGNS AND SYMPTOMS OF  
OVEREXPOSURE.Explanation of Carcinogenicity:SUSPECTED HUM CARCIN/KNOWN ANIM CARCIN  
(NTP 1985).INADEQ EVID FOR CARC IN HUM,SUFF EVID FOR CARC IN  
ANIMALS (IARC 1987).

Effects of Overexposure:EYES/SKIN/INGESTION/INHALATION:N/K .

Medical Cond Aggravated by Exposure:N/K

## ===== First Aid Measures =====

First Aid:EYES:FLUSH WITH WATER FOR AT LEAST 15 MINUTES.SKIN:FLUSH WITH  
LARGE VOLUMES OF WATER.REMOVE CONTAMINATED  
CLOTHING.INGESTION:CONTACT PHYSICIAN.INHALATION:IMMEDIATELY MOVE  
TO FRESH AIR.GIVE OXYGEN IF BREATHING IS LABORED.IF BREATHING  
STOPS,GIVE ARTIFICIAL RESPIRATION.CONTACT PHYSICIAN.

===== Fire Fighting Measures =====

Flash Point:N/K  
Lower Limits:N/K  
Upper Limits:N/K  
Extinguishing Media:CO\*2,FOAM,DRY CHEMICAL.  
Fire Fighting Procedures:USE NIOSH/MSHA APPROVED SCBA AND FULL  
PROTECTIVE EQUIPMENT .

===== Accidental Release Measures =====

Spill Release Procedures:SWEEP UP MATERIAL.VENTILATE AREA.AVOID  
GENERATING DUST.  
Neutralizing Agent:N/K

===== Handling and Storage =====

Handling and Storage Precautions:STORE IN SEALED CONTAINER IN COOL,DRY  
LOCATION.KEEP AWAY FROM OXIDIZERS.AVOID GENERATING DUST.  
Other Precautions:REPORTED CANCER HAZARD.AVOID EYE OR SKIN CONTACT.

===== Exposure Controls/Personal Protection =====

Respiratory Protection:NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR  
EXPOSURE OF CONCERN .  
Ventilation:LOCAL AND GENERAL VENTILATION NECESSARY TO KEEP AIR  
CONCENTRATION BELOW LEVEL OF CONCERN .  
Protective Gloves:RUBBER  
Eye Protection:CHEMICAL WORKERS GOGGLES .  
Work Hygienic Practices:N/K  
Supplemental Safety and Health  
ROUTES OF ENTRY:INHALATION/SKIN/INGESTION .

===== Physical/Chemical Properties =====

Boiling Pt:B.P. Text:438C,820F  
Melt/Freeze Pt:M.P/F.P Text:157C,315F  
Decomp Temp:Decomp Text:N/K  
Appearance and Odor:PALE YELLOW CRYSTAL.

===== Stability and Reactivity Data =====

Stability Indicator/Materials to Avoid:YES  
OXIDIZING AGENTS.

===== Disposal Considerations =====

Waste Disposal Methods:DISPOSAL MUST BE IN ACCORDANCE WITH  
FEDERAL,STATE AND LOCAL REGULATIONS .

Disclaimer (provided with this information by the compiling agencies):  
This information is formulated for use by elements of the Department  
of Defense. The United States of America in no manner whatsoever,



expressly or implied, warrants this information to be accurate and disclaims all liability for its use. Any person utilizing this document should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation.



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NONFLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas:

Oxygen 0-23.5%; Isobutylene, 0.0005-0.9%

SYNONYMS: Not Applicable CHEMICAL FAMILY NAME: Not Applicable FORMULA: Not Applicable

Document Number: 50054

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

|                                             |                                                  |
|---------------------------------------------|--------------------------------------------------|
| PRODUCT USE:                                | Calibration of Monitoring and Research Equipment |
| U.S. SUPPLIER/MANUFACTURER'S NAME:          | CALGAZ                                           |
| ADDRESS:                                    | 821 Chesapeake Drive<br>Cambridge, MD 21613      |
| BUSINESS PHONE:                             | 1-410-228-6400 (8 a.m. to 5 p.m. U.S. EST)       |
| General MSDS Information:                   | 1-713-868-0440                                   |
| Fax on Demand:                              | 1-800-231-1366                                   |
| EMERGENCY PHONE:                            |                                                  |
| Chemtrec: United States/Canada/Puerto Rico: | 1-800-424-9300 [24-hours]                        |
| Chemtrec International:                     | 1-703-527-3887 [24-hours]                        |

2. COMPOSITION and INFORMATION ON INGREDIENTS

| CHEMICAL NAME | CAS #     | mole %      | EXPOSURE LIMITS IN AIR                                                                                                                    |             |            |             |                      |                  |
|---------------|-----------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------|-------------|----------------------|------------------|
|               |           |             | ACGIH-TLV                                                                                                                                 |             | OSHA-PEL   |             | NIOSH<br>IDLH<br>ppm | OTHER<br><br>ppm |
|               |           |             | TWA<br>ppm                                                                                                                                | STEL<br>ppm | TWA<br>ppm | STEL<br>ppm |                      |                  |
| Isobutylene   | 115-11-7  | 0.0005-0.9% | There are no specific exposure limits for Isobutylene.                                                                                    |             |            |             |                      |                  |
| Oxygen        | 7782-44-7 | 0-23.5%     | There are no specific exposure limits for Oxygen.                                                                                         |             |            |             |                      |                  |
| Nitrogen      | 7727-37-9 | Balance     | There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%. |             |            |             |                      |                  |

NE = Not Established. See Section 16 for Definitions of Terms Used.  
NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This is a colorless, odorless gas mixture. Releases of this gas mixture may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene, a component of this gas mixture, may cause drowsiness and other central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The chief health hazard associated with this gas mixture is when this gas mixture contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

| CONCENTRATION OF OXYGEN | OBSERVED EFFECT                                                              |
|-------------------------|------------------------------------------------------------------------------|
| 12-16% Oxygen:          | Breathing and pulse rate increase, muscular coordination slightly disturbed. |
| 10-14% Oxygen:          | Emotional upset, abnormal fatigue, disturbed respiration.                    |
| 6-10% Oxygen:           | Nausea, vomiting, collapse, or loss of consciousness.                        |
| Below 6%:               | Convulsive movements, possible respiratory collapse, and death.              |

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:  
ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. The most significant hazard associated with this gas mixture when it contains less than 19.5% oxygen is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color. Additionally, Isobutylene, a component of this gas mixture, may cause drowsiness or central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.  
CHRONIC: Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.  
TARGET ORGANS: ACUTE: Respiratory system, eyes. CHRONIC: Heart, cardiovascular system, central nervous system.

| HAZARDOUS MATERIAL IDENTIFICATION SYSTEM             |             |            |
|------------------------------------------------------|-------------|------------|
| HEALTH HAZARD                                        | (BLUE)      | 1          |
| FLAMMABILITY HAZARD                                  | (RED)       | 0          |
| PHYSICAL HAZARD                                      | (YELLOW)    | 0          |
| PROTECTIVE EQUIPMENT                                 |             |            |
| EYES                                                 | RESPIRATORY | HANDS BODY |
| See Section 8                                        |             |            |
| For Routine Industrial Use and Handling Applications |             |            |

#### 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.**

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Acute or chronic respiratory conditions may be aggravated by over-exposure to this gas mixture.

**RECOMMENDATIONS TO PHYSICIANS:** Administer oxygen, if necessary; treat symptoms and eliminate exposure.

#### 5. FIRE-FIGHTING MEASURES

**FLASH POINT:** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

**FIRE EXTINGUISHING MATERIALS:** Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

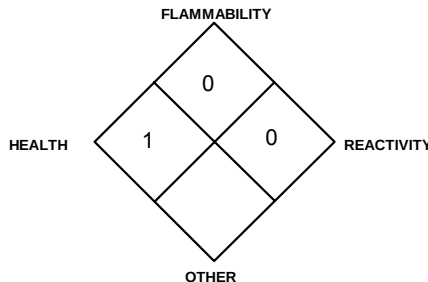
**UNUSUAL FIRE AND EXPLOSION HAZARDS:** This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

#### NFPA RATING



#### 6. ACCIDENTAL RELEASE MEASURES

**LEAK RESPONSE:** Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

#### 7. HANDLING and USE

**WORK PRACTICES AND HYGIENE PRACTICES:** Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

**STORAGE AND HANDLING PRACTICES:** Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING!** Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

#### 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Nitrous Oxide and Oxygen.

**RESPIRATORY PROTECTION:** No special respiratory protection is required under normal circumstances of use. Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection when oxygen levels are below 19.5%, or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check the concentration of Methane and Oxygen. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

**EYE PROTECTION:** Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

**HAND PROTECTION:** Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

**BODY PROTECTION:** No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

#### 9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, a main component of this gas mixture.

**GAS DENSITY @ 32°F (0°C) and 1 atm:** 0.072 lbs/ ft<sup>3</sup> (1.153 kg/m<sup>3</sup>)

**BOILING POINT:** -195.8°C (-320.4°F)

**SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 0.906

**SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm:** 0.023

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**ODOR THRESHOLD:** Not applicable.

**VAPOR PRESSURE @ 70°F (21.1°C) psig:** Not applicable.

The following information is for Oxygen, a main component of this gas mixture.

**GAS DENSITY @ 32°F (0°C) and 1 atm:** 0.083 lb/cu ft (1.326 kg/m<sup>3</sup>)

**FREEZING/MELTING POINT @ 10 psig:** -218.8°C (-361.8°F)

**SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 1.105

**SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm:** 0.04.91

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**ODOR THRESHOLD:** Not applicable.

**VAPOR PRESSURE @ 70°F (21.1°C) psig:** Not applicable.

The following information is for the gas mixture.

**APPEARANCE AND COLOR:** This is a colorless, odorless gas mixture.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** There are no unusual warning properties associated with a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

**FREEZING/MELTING POINT @ 10 psig:** -210°C (-345.8°F)

**pH:** Not applicable.

**MOLECULAR WEIGHT:** 28.01

**EXPANSION RATIO:** Not applicable.

**SPECIFIC VOLUME (ft<sup>3</sup>/lb):** 13.8

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable.

**BOILING POINT:** -183.0°C (-297.4°F)

**pH:** Not applicable.

**MOLECULAR WEIGHT:** 32.00

**EXPANSION RATIO:** Not applicable.

**VOLUME (ft<sup>3</sup>/lb):** 12.1

**COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable.

10. STABILITY and REACTIVITY

**STABILITY:** Normally stable in gaseous state.

**DECOMPOSITION PRODUCTS:** The thermal decomposition products of Isobutylene include carbon oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Titanium will burn in the Nitrogen component of this gas mixture. Lithium reacts slowly with Nitrogen at ambient temperatures. The Isobutylene component of this gas mixture is also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride).

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

**TOXICITY DATA:** The following toxicology data are available for the components of this gas mixture:

**ISOBUTYLENE:**  
LC<sub>50</sub> (inhalation, rat) = 620,000 mg/kg/4 hours  
LC<sub>50</sub> (inhalation, mouse) = 415,000 mg/kg

**NITROGEN:**  
There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

**SUSPECTED CANCER AGENT:** The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

**IRRITANCY OF PRODUCT:** Contact with rapidly expanding gases can be irritating to exposed skin and eyes.

**SENSITIZATION TO THE PRODUCT:** The components of this gas mixture are not known to cause human skin or respiratory sensitization.

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of this gas mixture and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for the components in this gas mixture.

Embryotoxicity: No embryotoxic effects have been described for the components in this gas mixture.

Teratogenicity: No teratogenicity effects have been described for the components in this gas mixture.

Reproductive Toxicity: No reproductive toxicity effects have been described for the components in gas mixture.

A *mutagen* is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An *embryotoxin* is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A *teratogen* is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance which interferes in any way with the reproductive process.

**BIOLOGICAL EXPOSURE INDICES (BEIs):** Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

**ENVIRONMENTAL STABILITY:** The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

**OXYGEN:** Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K<sub>ow</sub> = -0.65

**NITROGEN:** Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

**EFFECT OF MATERIAL ON PLANTS or ANIMALS:** No evidence is currently available on the effects of this gas mixture on plant and animal life.

**EFFECT OF CHEMICAL ON AQUATIC LIFE:** No evidence is currently available on the effects of this gas mixture on aquatic life.

13. DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL:** Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

**THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.**

**PROPER SHIPPING NAME:** Compressed gases, n.o.s. (\*Oxygen, Nitrogen)\*or the gas component with the next highest concentration next to Nitrogen.

**HAZARD CLASS NUMBER and DESCRIPTION:** 2.2 (Non-Flammable Gas)

**UN IDENTIFICATION NUMBER:** UN 1956

**PACKING GROUP:** Not applicable.

**DOT LABEL(S) REQUIRED:** Class 2.2 (Non-Flammable Gas)

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000):** 126

**MARINE POLLUTANT:** The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

**Note:** DOT 39 Cylinders ship in a strong outer carton (outer package). Pertinent shipping information goes on the outside of the outer package. DOT 39 Cylinders do not have transportation information on the cylinder itself.

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This gas is considered as Dangerous Goods, per regulations of Transport Canada.

**PROPER SHIPPING NAME:** Compressed gases, n.o.s. (\*Oxygen, Nitrogen)\*or the gas component with the next highest concentration next to Nitrogen.

**HAZARD CLASS NUMBER and DESCRIPTION:** 2.2 (Non-Flammable Gas)

**UN IDENTIFICATION NUMBER:** UN 1956

**PACKING GROUP:** Not Applicable

**HAZARD LABEL:** Class 2.2 (Non-Flammable Gas)

**SPECIAL PROVISIONS:** None

**EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX:** 0.12

**ERAP INDEX:** None

**PASSENGER CARRYING SHIP INDEX:** None

**PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX:** 75

**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000):** 126

**NOTE:** Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

**ADDITIONAL U.S. REGULATIONS:**

**U.S. SARA REPORTING REQUIREMENTS:** The components of this gas mixture are not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

**U.S. SARA THRESHOLD PLANNING QUANTITY:** There are no specific Threshold Planning Quantities for this gas mixture. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

**U.S. TSCA INVENTORY STATUS:** The components of this gas mixture are listed on the TSCA Inventory.

**U.S. CERCLA REPORTABLE QUANTITY (RQ):** Not applicable.

**OTHER U.S. FEDERAL REGULATIONS:**

- No component of this gas mixture is subject to the requirements of CFR 29 1910.1000 (under the 1989 PELs).
- Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.
- The regulations of the Process Safety Management of Highly Hazardous Chemicals are not applicable (29 CFR 1910.119).
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).

## 15. REGULATORY INFORMATION (continued)

- Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Isobutylene is listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,554 kg) or greater.

**U.S. STATE REGULATORY INFORMATION:** The components of this gas mixture are covered under the following specific State regulations:

**Alaska - Designated Toxic and Hazardous Substances:** No.

**California - Permissible Exposure Limits for Chemical Contaminants:** Nitrogen.

**Florida - Substance List:** Oxygen, Isobutylene.

**Illinois - Toxic Substance List:** No.

**Kansas - Section 302/313 List:** No.

**Massachusetts - Substance List:** Oxygen, Isobutylene.

**Michigan - Critical Materials Register:** No.

**Minnesota - List of Hazardous Substances:** No.

**Missouri - Employer Information/Toxic Substance List:** No.

**New Jersey - Right to Know Hazardous Substance List:** Oxygen, Nitrogen, Isobutylene.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** No.

**Pennsylvania - Hazardous Substance List:** Oxygen, Nitrogen, Isobutylene.

**Rhode Island - Hazardous Substance List:** Oxygen, Nitrogen.

**Texas - Hazardous Substance List:** No.

**West Virginia - Hazardous Substance List:** No.

**Wisconsin - Toxic and Hazardous Substances:** : No.

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** No component of this gas mixture is on the California Proposition 65 lists.

**ADDITIONAL CANADIAN REGULATIONS:**

**CANADIAN DSL/NDL INVENTORY STATUS:** The components of this gas mixture are listed on the DSL Inventory.

**CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS:** The components of this gas mixture are not on the CEPA Priorities Substances Lists.

**CANADIAN WHMIS REGULATIONS:** This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

## 16. OTHER INFORMATION

### INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

**MIXTURES:** When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

|      |                                                   |
|------|---------------------------------------------------|
| P-1  | "Safe Handling of Compressed Gases in Containers" |
| AV-1 | "Safe Handling and Storage of Compressed Gases"   |
|      | "Handbook of Compressed Gases"                    |



This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

**Community Air Monitoring Plan  
(CAMP)  
LPC Development Group LLC  
337 Berry and 95-105 South 5<sup>th</sup> Street  
Brooklyn, New York**

## 1.0 INTRODUCTION

---

### 1.1 Background

In accordance with the New York State Department of Health (NYSDOH) and New York State DER-10 Technical Guidance for Site Investigation and Remediation, a Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

This CAMP has been developed to address particulates (dust) and potential subsurface organic vapors that may be released to the air during implementation of the interim remedial action activities. The CAMP was prepared in accordance with New York State Department of Health (NYSDOH) requirements presented in Appendix 1A of the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (2010). The CAMP requires real-time monitoring for dust and organic vapors at the upwind and downwind perimeters of each designated work area. The measures included in the CAMP will provide a level of protection for the occupants of the neighboring properties and water bodies as well as the downwind community, from potential airborne releases. The CAMP sets forth specific action levels for determining monitoring frequency and the appropriate corrective actions, including work shutdown.

### 1.2 Objectives and Procedures of the CAMP

The intention of the CAMP is to monitor air quality at areas where soil is being disturbed or loaded during the remedial activities as stated in the Interim Remedial Measures Work Plan. The CAMP for this project describes monitoring of dust and vapors on a real-time, continuous basis. Air monitoring will involve standard monitoring functions for environmental projects including real-time air monitoring for particulate matter less than 10 micrometers in size (PM-10) and volatile organic compounds (VOCs); observations for visible dust emissions and odors; inspection and monitoring of the contractor's work practices; and reporting to the NYSDEC and NYSDOH.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities

include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, the installation of soil borings or monitoring wells, and vapor mitigation systems. As such, continuous monitoring will be performed during all ground intrusive activities associated with the project site.

The objectives of the CAMP consist of the following:

- Monitor dust as PM-10 on a real-time, continuous basis such that dust associated with the investigative and remedial actions is maintained below action levels.
- Monitor organic vapors as VOCs on a real-time, continuous basis such that potential vapors associated with the investigative and remedial actions are maintained below action levels.
- Monitor odors and dust emissions (based on olfactory and visible evidence) so that vapors and dust from work areas do not leave the Site.
- In the event that PM-10 or VOC concentrations exceed action levels, Site personnel will be immediately notified so that all necessary corrective actions can be taken.

### 1.3 Future Actions

Should there be any intrusive work onsite, the CAMP will be implemented to ensure the safety of the field team, tenants, and local residents.

## 2.0 CAMP PROCEDURES

---

### 2.1 VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than

25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.
- All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

## **2.2 Particulate Monitoring, Response Levels, and Actions**

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m<sup>3</sup>) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m<sup>3</sup> above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m<sup>3</sup> above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m<sup>3</sup> of the upwind level and in preventing visible dust migration.
- All readings will be recorded and be available for State (DEC and DOH) personnel to review.

## **3.0 Monitoring Equipment**

---

The activities, as part of the CAMP, will be performed by trained and qualified personnel. In addition, Equity personnel who perform air monitoring functions described in this CAMP will be experienced in the use of air monitoring equipment and procedures.

---



All monitoring equipment will be calibrated on a daily basis (before the monitoring session begins) in accordance with the manufacturer's operation instructions. A dedicated field notebook will be maintained during the course of the CAMP which will provide record of the details, time and dates of calibration and concentrations of the particulate matter and organic vapors throughout the monitoring sessions.

The equipment to be used throughout this CAMP consists of the following:

- TSI DUSTTRAK II Desktop 8530 Dust/Aerosol Monitor – with PM-10 filter and Strobe light/Audible Alarm and Data logger. One upwind and one downwind station will be utilized as part of the CAMP.
- MiniRAE 3000 (or equivalent) Photoionization Detector. One upwind and one downwind unit will be utilized as part of the CAMP.

#### 4.0 Controlling Particulate Generation and Migration

---

It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential-- such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

- Applying water on haul roads;
- Wetting equipment and excavation faces;
- Spraying water on buckets during excavation and dumping;
- Hauling materials in properly tarped or watertight containers;
- Restricting vehicle speeds to 10 mph;
- Covering excavated areas and material after excavation activity ceases; and
- Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m<sup>3</sup> action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using

atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

## **APPENDIX G**

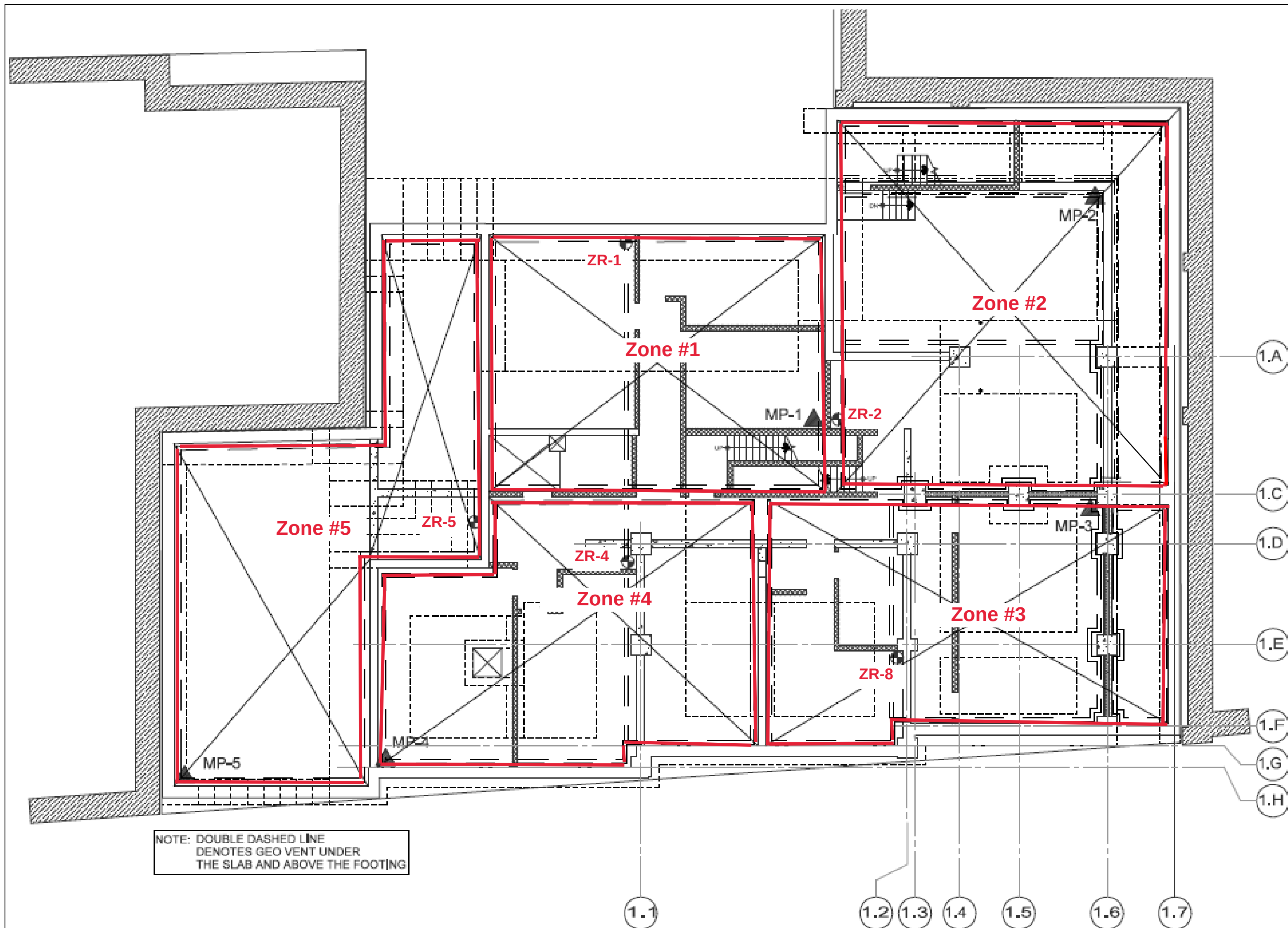
### **OPERATIONS & MAINTENANCE**

#### **O&M MANUAL - SSDS**

The O&M Manual provides protocols for the operation and maintenance of a remedial system. The procedures detailed in the O&M Manual do not replace the manufacturer's documents for specific remedial components but rather supplement such documents and provide for a concise, organized reference document for the remedial system and associated remedial components for operation and maintenance.

The O&M Manual includes all as-built drawings and catalog-cuts on all fixed and mobile equipment necessary to operate and maintain the remedial system including any pumps, blower, air strippers, etc. Catalog-cuts will include maintenance procedures, spare parts lists, and any special tool requirement as well as vendor/service contact/local dealer information, including address and telephone numbers.

The O&M Manual is to be revised on a periodic basis and must be kept up to date by the remedial party.



## Sub-Slab Depressurization Systems

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**  
500 International Drive, Suite 150 Mt. Olive, NJ 07828  
(973) 527-7451 (v) / (973) 858-0280 (f)

| DRAWN BY/ DATE | CHK/DATE | DRAWING NUMBER |
|----------------|----------|----------------|
| JV / 01-03-17  |          | 2015059-05     |

# Installation and Operation Manual

Item #: 484840  
Rev Date: 2016-09-09

## HP/FR Series

Inline Radon Fans



### Technical / Customer Support:

Support technique et service à la clientèle

United States / États-Unis Tel.: 800.747.1762

Canada Tel.: 800.565.3548



**fantech**<sup>®</sup>  
a systemair company

|      |                          |             |                       |               |
|------|--------------------------|-------------|-----------------------|---------------|
|      |                          |             |                       |               |
| Note | Warning / Important note | Information | Technical information | Practical tip |



**DO NOT CONNECT POWER SUPPLY until fan is completely installed.**  
**Make sure electrical service to the fan is in the locked “OFF” position.**

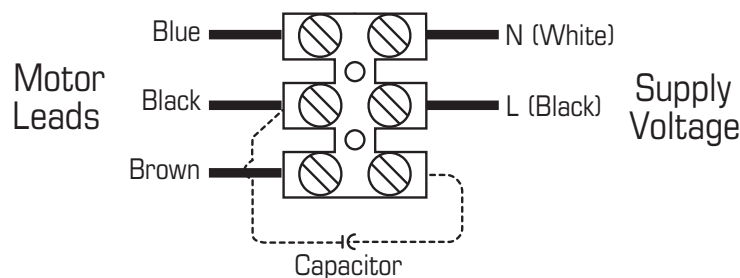
1. Suitable for use with solid-state speed control.
2. WARNING! TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, OR INJURY TO PERSONS - OBSERVE THE FOLLOWING:
  - a. Use this unit in the manner intended by the manufacturer. If you have any questions, contact your manufacturer's representative or contact us directly.
  - b. CAUTION: Before installation, servicing or cleaning unit, switch power off at service panel and lock the service disconnection means to prevent power from being switched on accidentally. When the service disconnection means cannot be locked, securely fasten a prominent warning device, such as tag, to the panel.
  - c. Installation work and electrical wiring must be done by qualified person(s) in accordance with all applicable codes and standards, including fire-rated construction.
  - d. The combustion airflow needed for safe operation of fuel burning equipment may be affected by this unit's operation. Follow the heating equipment manufacturer's guidelines and safety standards such as those published by the National Fire Protection Association (NFPA), the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) and the local code authorities.
  - e. When cutting or drilling into wall and ceiling, do not damage electrical wiring and other hidden utilities.
  - f. Ducted fans must always be vented to the outdoors.
  - g. If this unit is to be installed over a tub or shower, it must be marked as appropriate for the application and be connected to a GFCI (Ground Fault Circuit Interrupter) - protected branch circuit.
  - h. NEVER place a switch where it can be reached from a tub or shower.
3. WARNING! Check voltage at the fan to see if it corresponds to the motor name plate.

**GUARDS MUST BE INSTALLED WHEN FAN IS WITHIN REACH OF PERSONNEL OR WITHIN SEVEN (7) FEET OF WORKING LEVEL OR WHEN DEEMED ADVISABLE FOR SAFETY.**



The ducting from this fan to the outside of the building has a strong effect on the air flow, noise and energy use of the fan. Use the shortest, straightest duct routing possible for best performance, and avoid installing the fan with smaller ducts than recommended. Insulation around the ducts can reduce energy loss and inhibit mold growth. Fans installed with existing ducts may not achieve their rated air flow.

## WIRING DIAGRAM



# WARRANTY

## Five (5) Year Warranty

**This warranty supersedes all prior warranties**

### **DURING ENTIRE WARRANTY PERIOD:**

Fantech will repair or replace any part which has a factory defect in workmanship or material. Product may need to be returned to the Fantech factory, together with a copy of the bill of sale and identified with RMA number.

### **FOR FACTORY RETURN YOU MUST:**

- Have a Return Materials Authorization (RMA) number. This may be obtained by calling Fantech either in the USA at 1.800.747.1762 or in CANADA at 1.800.565.3548. Please have bill of sale available.
- The RMA number must be clearly written on the outside of the carton, or the carton will be refused.
- All parts and/or product will be repaired/replaced and shipped back to buyer; no credit will be issued.

### **OR**

The Distributor may place an order for the warranty part and/or product and is invoiced. The Distributor will receive a credit equal to the invoice only after product is returned prepaid and verified to be defective.

FANTECH WARRANTY TERMS DO NOT PROVIDE FOR REPLACEMENT WITHOUT CHARGE PRIOR TO INSPECTION FOR A DEFECT. REPLACEMENTS ISSUED IN ADVANCE OF DEFECT INSPECTION ARE INVOICED, AND CREDIT IS PENDING INSPECTION OF RETURNED MATERIAL. DEFECTIVE MATERIAL RETURNED BY END USERS SHOULD NOT BE REPLACED BY THE DISTRIBUTOR WITHOUT CHARGE TO THE

END USER, AS CREDIT TO DISTRIBUTOR'S ACCOUNT WILL BE PENDING INSPECTION AND VERIFICATION OF ACTUAL DEFECT BY FANTECH.

### **THE FOLLOWING WARRANTIES DO NOT APPLY:**

- Damages from shipping, either concealed or visible. Claim must be filed with freight company.
- Damages resulting from improper wiring or installation.
- Damages or failure caused by acts of God, or resulting from improper consumer procedures, such as:
  1. Improper maintenance
  2. Misuse, abuse, abnormal use, or accident, and
  3. Incorrect electrical voltage or current.
- Removal or any alteration made on the Fantech label control number or date of manufacture.
- Any other warranty, expressed, implied or written, and to any consequential or incidental damages, loss or property, revenues, or profit, or costs of removal, installation or reinstallation, for any breach of warranty.

### **WARRANTY VALIDATION**

- The user must keep a copy of the bill of sale to verify purchase date.
- These warranties give you specific legal rights, and are subject to an applicable consumer protection legislation. You may have additional rights which vary from state to state.

## Limitation of Warranty and Liability

This warranty does not apply to any Fantech product or part which has failed as a result of faulty installation or abuse, incorrect electrical connections or alterations made by others, or use under abnormal operating conditions or misapplication of the product or parts. We will not approve for payment any repair not made by us or our authorized agent without prior written consent. The foregoing shall constitute our sole and exclusive warranty and our sole exclusive liability, and is in lieu of any other warranties, whether written, oral, implied or statutory. There are no warranties which extend beyond the description on the page hereof. In no event, whether as a result of breach of contract, or

warranty or alleged negligence, defect incorrect advice or other causes, shall Fantech be liable for special or consequential damages, including, but not limited to, loss of profits or revenue, loss of use of equipment or any other associated equipment, cost of capital, cost of substitute equipment, facilities or services, downtime costs, or claims of customers of purchase for such damages. Fantech neither assumes or authorizes any person to assume for it any other liability in connection with the sale of product(s) or part(s). Some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages so the above limitations and exclusions may not apply to you.

## Warning

Fantech products are designed and manufactured to provide reliable performance, but they are not guaranteed to be 100% free from defects. Even reliable products will experience occasional failures and this possibility should be recognized by the user. If these products are

used in a life support ventilation system where failure could result in loss or injury, the user should provide adequate backup ventilation, supplementary natural ventilation, failure alarm system, or acknowledge willingness to accept the risk of such loss or injury.

Fantech reserves the right to make technical changes.  
For updated documentation please refer to [www.fantech.net](http://www.fantech.net)

Fantech®





**INSTALLATION & OPERATING INSTRUCTIONS**  
**Instruction P/N IN015 Rev E**  
**FOR CHECKPOINT IIa™ P/N 28001-2 & 28001-3**  
**RADON SYSTEM ALARM**

**INSTALLATION INSTRUCTIONS**  
(WALL MOUNTING)

Select a suitable wall location near a vertical section of the suction pipe. The unit should be mounted about four or five feet above the floor and as close to the suction pipe as possible. Keep in mind that with the plug-in transformer provided, the unit must also be within six feet of a 120V receptacle. **NOTE: The Checkpoint IIa is calibrated for vertical mounting, horizontal mounting will affect switchpoint calibration.**

Drill two 1/4" holes 4" apart horizontally where the unit is to be mounted.

Install the two 1/4" wall anchors provided.

Hang the CHECKPOINT IIa from the two mounting holes located on the mounting bracket. Tighten the mounting screws so the unit fits snugly and securely against the wall.

Drill a 5/16" hole into the side of the vent pipe about 6" higher than the top of the unit.

Insert the vinyl tubing provided about 1" inside the suction pipe.

Cut a suitable length of vinyl tubing and attach it to the pressure switch connector on the CHECKPOINT IIa.

**CALIBRATION AND OPERATION.**

The CHECKPOINT IIa units are calibrated and sealed at the factory to alarm when the vacuum pressure falls below the factory setting and should not normally require field calibration. Factory Settings are:

**28001-2 - .25" WC Vacuum**

**28001-3 - .10" WC Vacuum**

**To Verify Operation:**

With the exhaust fan off or the pressure tubing disconnected and the CHECKPOINT IIa plugged in, both the red indicator light and the audible alarm should be on.

Turn the fan system on or connect the pressure tubing to the fan piping. The red light and the audible alarm should go off. The green light should come on.

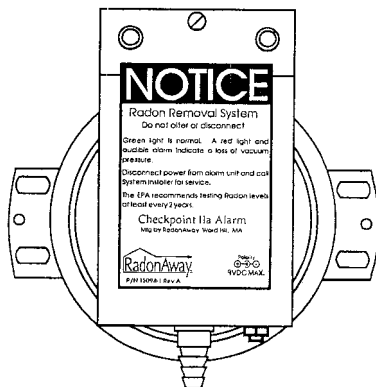
Now turn the fan off. The red light and audible alarm should come on in about two or three seconds and the green light should go out.

**WARRANTY INFORMATION**

Subject to applicable consumer protection legislation, RadonAway warrants that the CHECKPOINT IIa will be free from defective material and workmanship for a period of (1) year from the date of purchase. Warranty is contingent on installation in accordance with the instructions provided. This warranty does not apply where repairs or alterations have been made or attempted by others; or the unit has been abused or misused. Warranty does not include damage in shipment unless the damage is due to the negligence of RadonAway. All other warranties, expressed or written, are not valid. To make a claim under these limited warranties, you must return the defective item to RadonAway with a copy of the purchase receipt. RadonAway is not responsible for installation or removal cost associated with this warranty. In no case is RadonAway liable beyond the repair or replacement of the defective product FOB RadonAway.

**THERE ARE NO WARRANTIES WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF. THERE IS NO WARRANTY OF MERCHANTABILITY. ALL OTHER WARRANTIES, EXPRESSED OR WRITTEN, ARE NOT VALID.**

For service under these warranties, contact RadonAway for a Return Material Authorization (RMA) number and shipping information. **No returns can be accepted without an RMA.** If factory return is required, the customer assumes all shipping costs to and from factory.



Manufactured by:  
RadonAway  
Ward Hill, MA  
(978)-521-3703

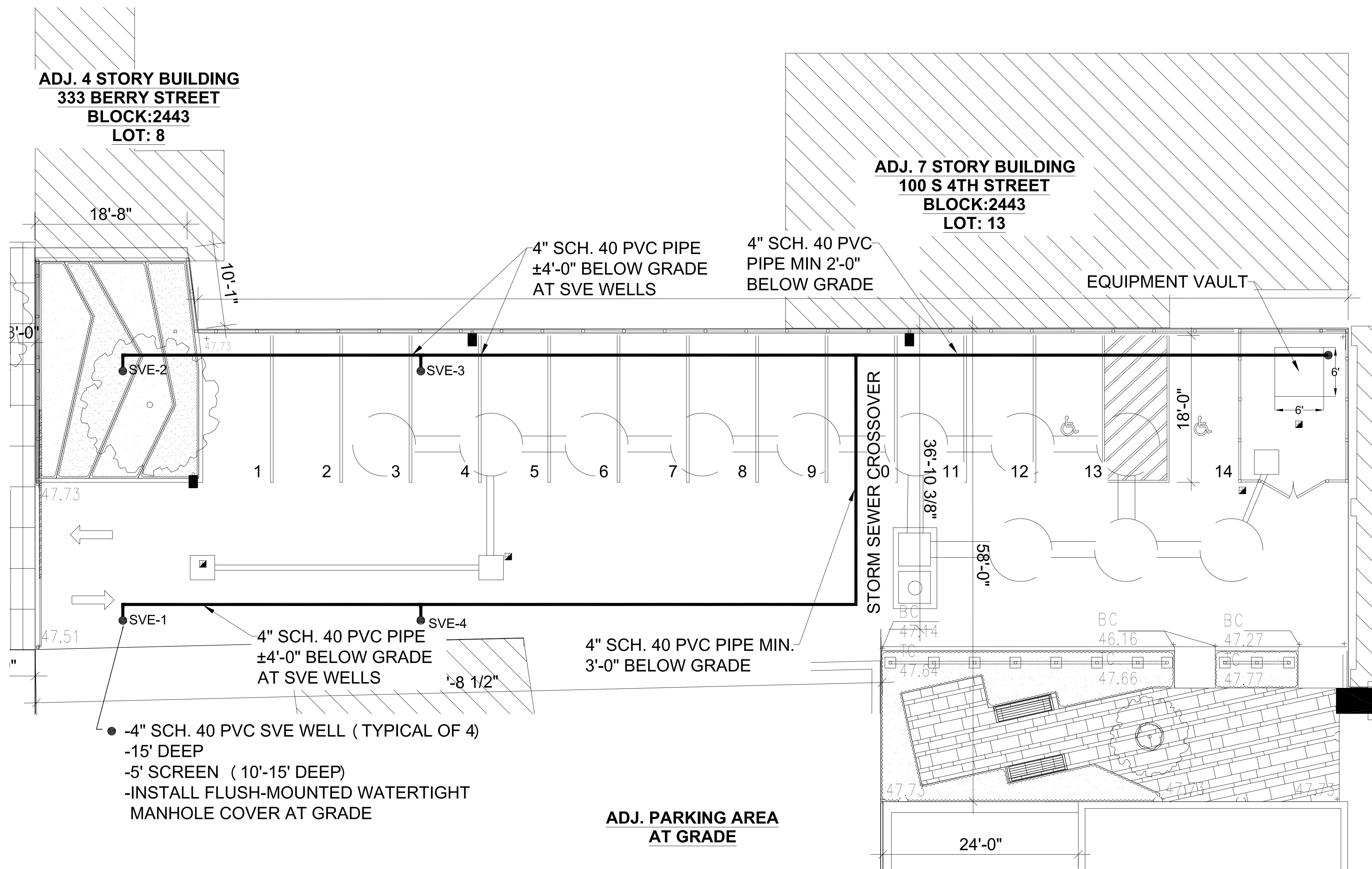
## **O&M MANUAL - SVE**

The O&M Manual provides protocols for the operation and maintenance of a remedial system. The procedures detailed in the O&M Manual do not replace the manufacturer's documents for specific remedial components but rather supplement such documents and provide for a concise, organized reference document for the remedial system and associated remedial components for operation and maintenance.

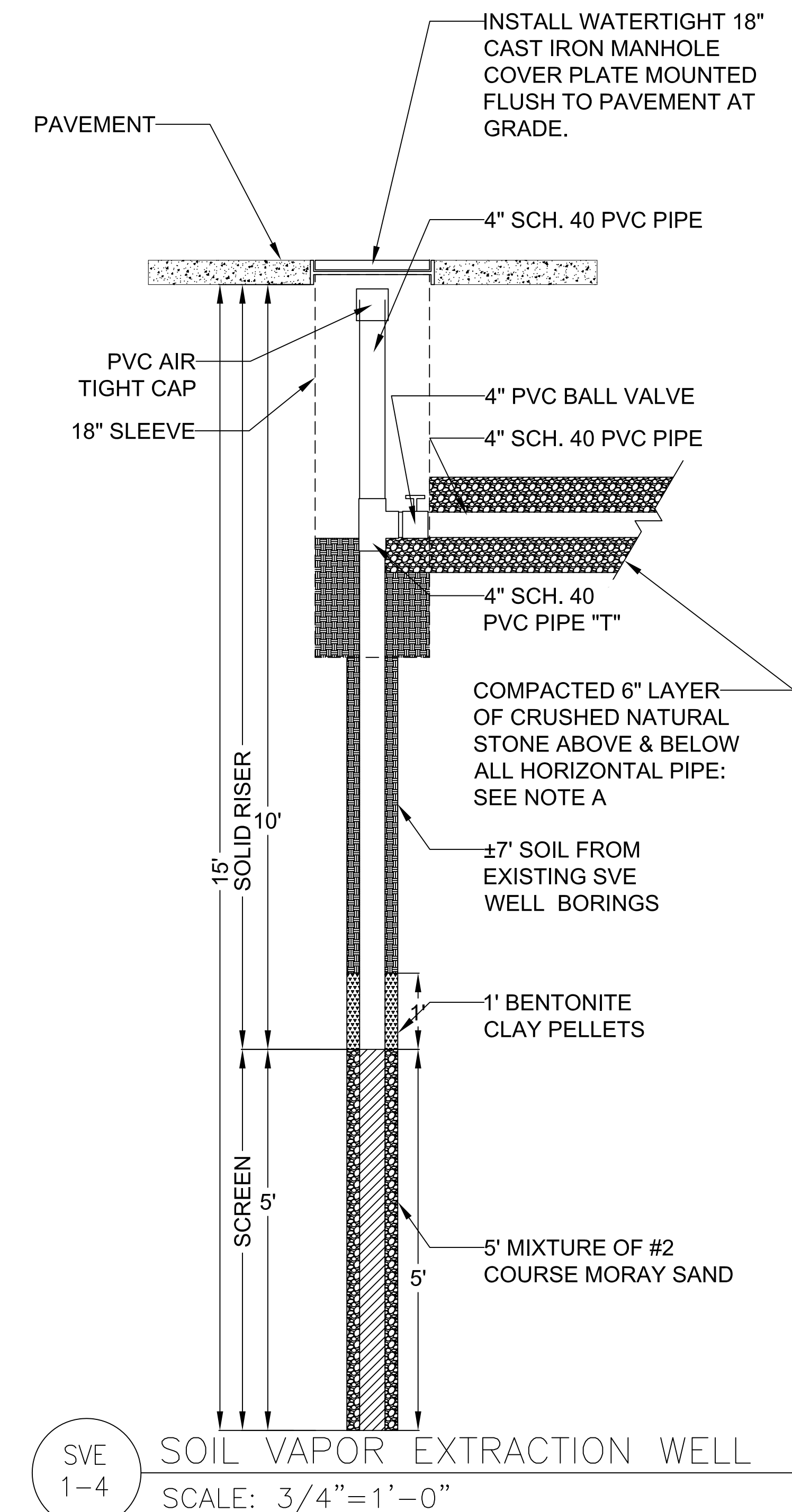
The O&M Manual includes all as-built drawings and catalog-cuts on all fixed and mobile equipment necessary to operate and maintain the remedial system including any pumps, blower, air strippers, etc. Catalog-cuts will include maintenance procedures, spare parts lists, and any special tool requirement as well as vendor/service contact/local dealer information, including address and telephone numbers.

The O&M Manual is to be revised on a periodic basis and must be kept up to date by the remedial party.

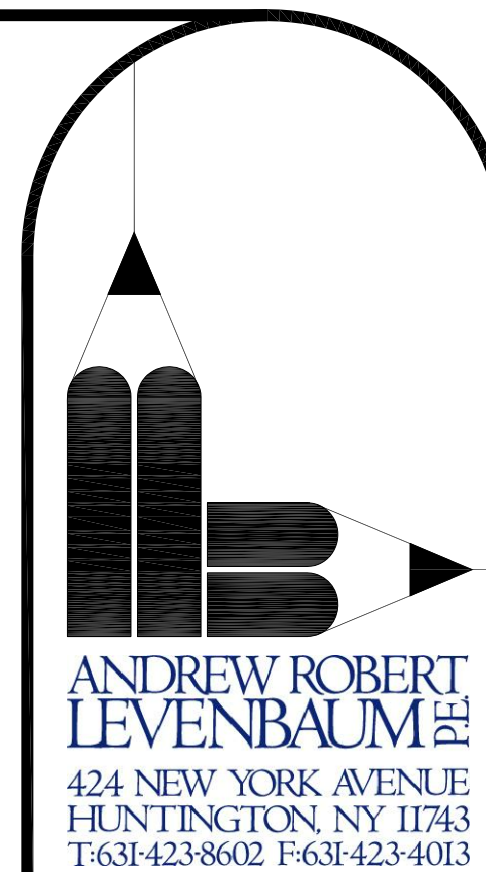
BERRY STREET



NOTE A: ALL HORIZONTAL PIPE INSTALLED IN THE MIDDLE OF A 12" LAYER OF CRUSHED NATURAL BLUESTONE, MINIMUM OF  $\frac{3}{4}$ " SIZE, FREE OF ALL FRIABLE MATERIAL AND DEBRIS, GRADED IN ACCORDANCE WITH ASTM C136; ALL MATERIAL TO BE ABLE TO PASS THROUGH A 2" SEIVE.



- FINE TO COURSE SAND AND ROUNDED GRAVEL
- BENTONITE PELLETS
- BANK RUN SAND AND GRAVEL
- CONCRETE
- SVE — SOIL VAPOR EXTRACTION WELL
- 18" Ø HI-DENSITY POLYETHYLENE SLEEVE



STRUCTURAL CONSULTANT:

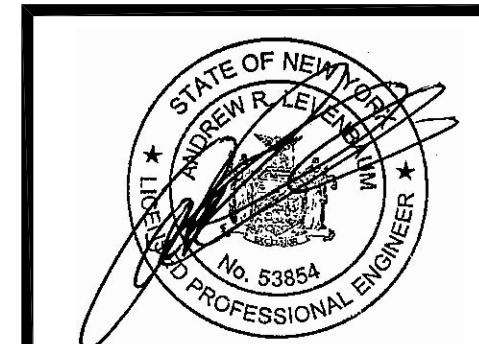
MEPS CONSULTANT:

THE DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS PREPARED BY THE ARCHITECT AND PROFESSIONAL ENGINEER FOR THIS PROJECT ARE THE INSTRUMENTS OF THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S SERVICES FOR USE SOLELY WITH RESPECT TO THIS PROJECT AND, UNLESS OTHERWISE PROVIDED, THE ARCHITECT AND PROFESSIONAL ENGINEER SHALL BE DEEMED THE AUTHOR OF THESE DOCUMENTS AND SHALL RETAIN ALL COMMON LAW, STATUTORY AND OTHER RESERVED RIGHTS INCLUDING COPYRIGHT. THE OWNER SHALL BE PERMITTED TO RETAIN COPIES OF THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS FOR THE PROJECT. THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S DRAWINGS SHALL NOT BE USED BY THE OWNER OR OTHERS ON OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR FOR COMPLETION OF THIS PROJECT BY OTHERS.

| NO | DESCRIPTION | DATE |
|----|-------------|------|
|    |             |      |
|    |             |      |
|    |             |      |

PROJECT DATA:  
ALTERATIONS & ADDITIONS TO:  
337 BERRY STREET  
BROOKLYN, NY 11249

JOB NUMBER: 593



DOB BSCAN:

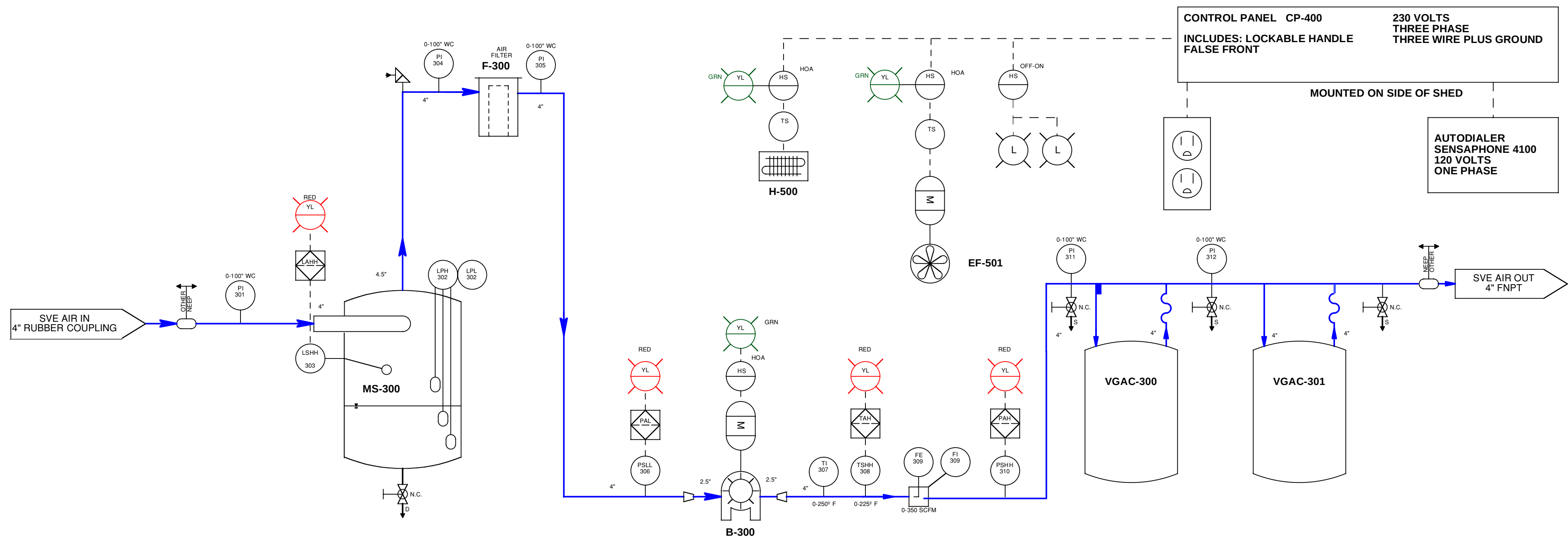
DRAWING TITLE:

SITE PLAN

DRAWN BY: BJR  
CHECKED BY: ARL  
SCALE:  $\frac{1}{8}$ " = 1'-0"  
DATE: 10.31.2018

C-101.00  
1 of 1









Advanced Cleanup Technologies, Inc.

ENVIRONMENTAL CONSULTANTS

# Operation & Maintenance Manual

---

ACT PROJECT NUMBER: 9311-BKNY, August 2018

PROJECT NAME: Soil Vapor Extraction System

337 Berry Street  
Brooklyn, NY

**Prepared for:**

**Procidadvanced Cleanup Technologies  
Inc. 110 Main Street  
Suite 103  
Port Washington, NY 11050**



**FPZ S.p.A.**  
Via F.lli Cervi 16  
20049 Concorezzo - (MB) - ITALIA  
Tel. +39 039 69 09 811  
Fax +39 039 60 41 296  
www.fpz.com

LATERAL CHANNEL BLOWERS - COMPRESSORS

**SCL K03 / K04 / K05 / K06**

**MS SERIES - MOR RANGE**

SN 1870-7 1/2

#### TECHNICAL CHARACTERISTICS

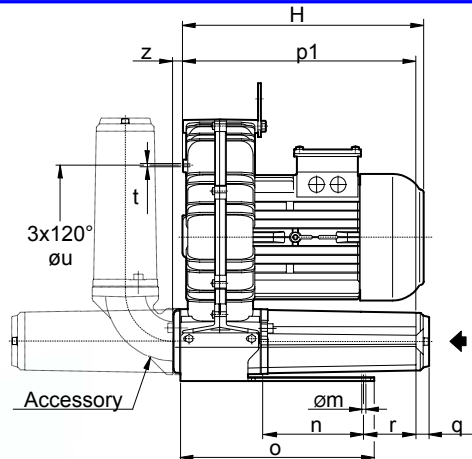
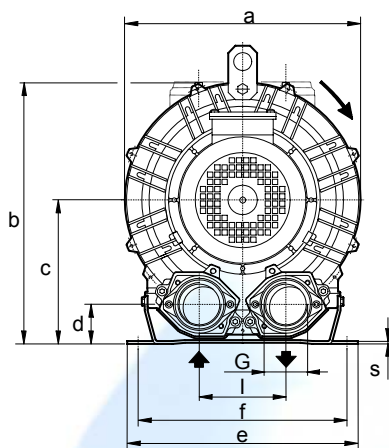
- Aluminium alloy construction
- Smooth operation
- High efficiency impeller
- Maintenance free
- Mountable in any position

#### OPTIONS

- Special voltages (IEC 38)
- Surface treatments

Possible alternative positions,  
please refer to drw SI 1835

Dimensions in mm.  
Dimensions for reference only

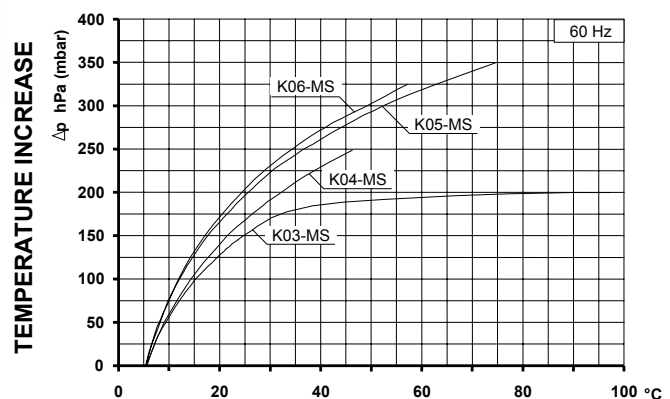
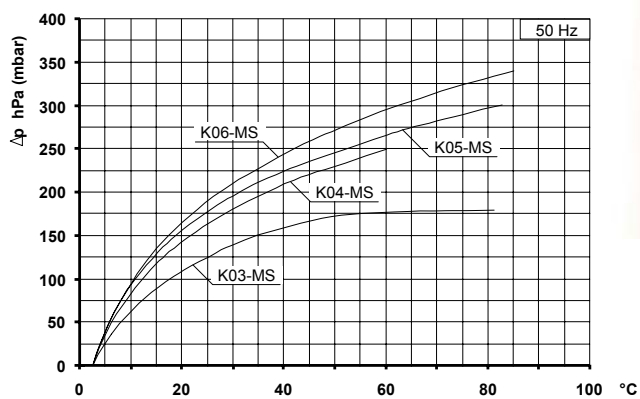
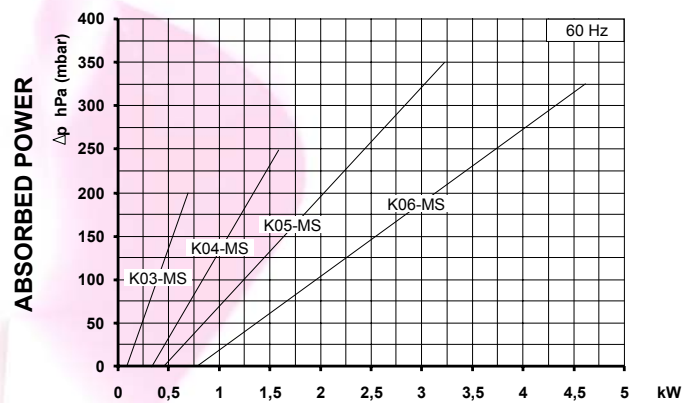
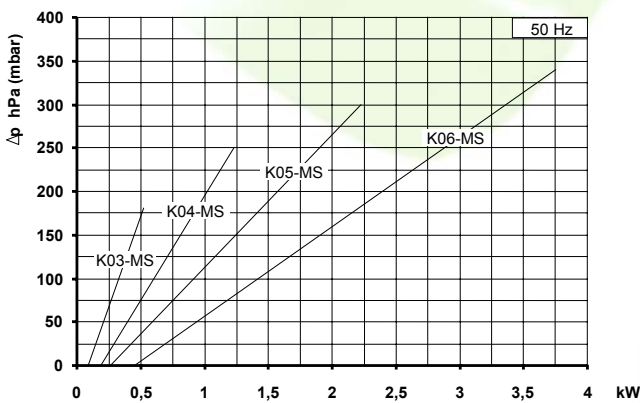
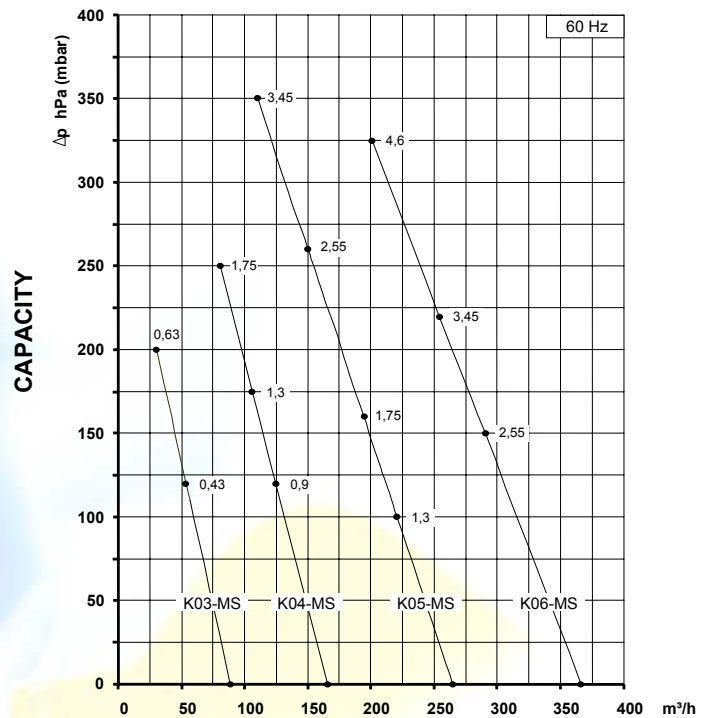
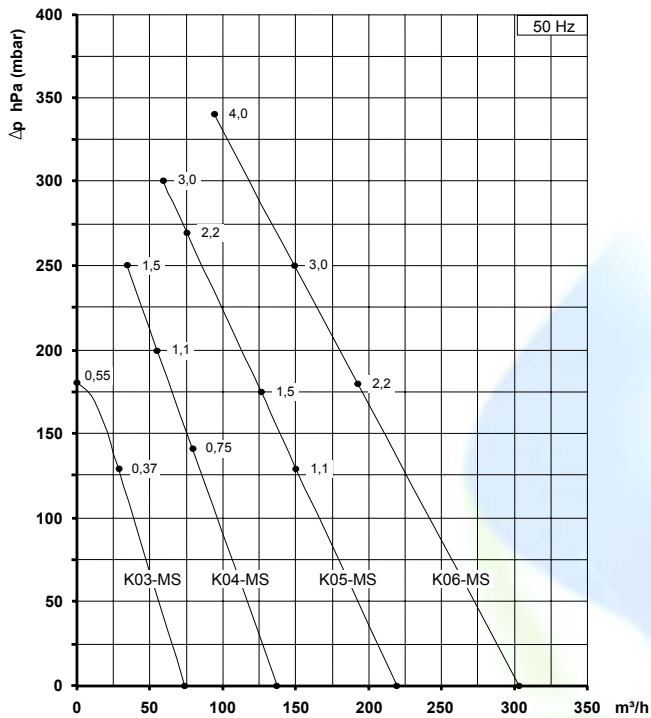


| Model  | a   | b   | c   | d  | e   | f   | G        | l   | m  | n   | o   | p1  | q  | r  | s | t  | u   | z  |
|--------|-----|-----|-----|----|-----|-----|----------|-----|----|-----|-----|-----|----|----|---|----|-----|----|
| K03-MS | 241 | 268 | 147 | 43 | 230 | 205 | G 1" 1/4 | 86  | 10 | 83  | 142 | 205 | 18 | 75 | 4 | M6 | 140 | 12 |
| K04-MS | 285 | 315 | 172 | 49 | 255 | 225 | G 1" 1/2 | 102 | 12 | 95  | 171 | 222 | 18 | 70 | 4 | M6 | 175 | 18 |
| K05-MS | 327 | 365 | 200 | 54 | 320 | 260 | G 2"     | 120 | 15 | 115 | 265 | 320 | 18 | 98 | 4 | M8 | 200 | 19 |
| K06-MS | 376 | 393 | 205 | 54 | 325 | 290 | G 2"     | 125 | 15 | 140 | 272 | 334 | 18 | 85 | 4 | M8 | 240 | 19 |

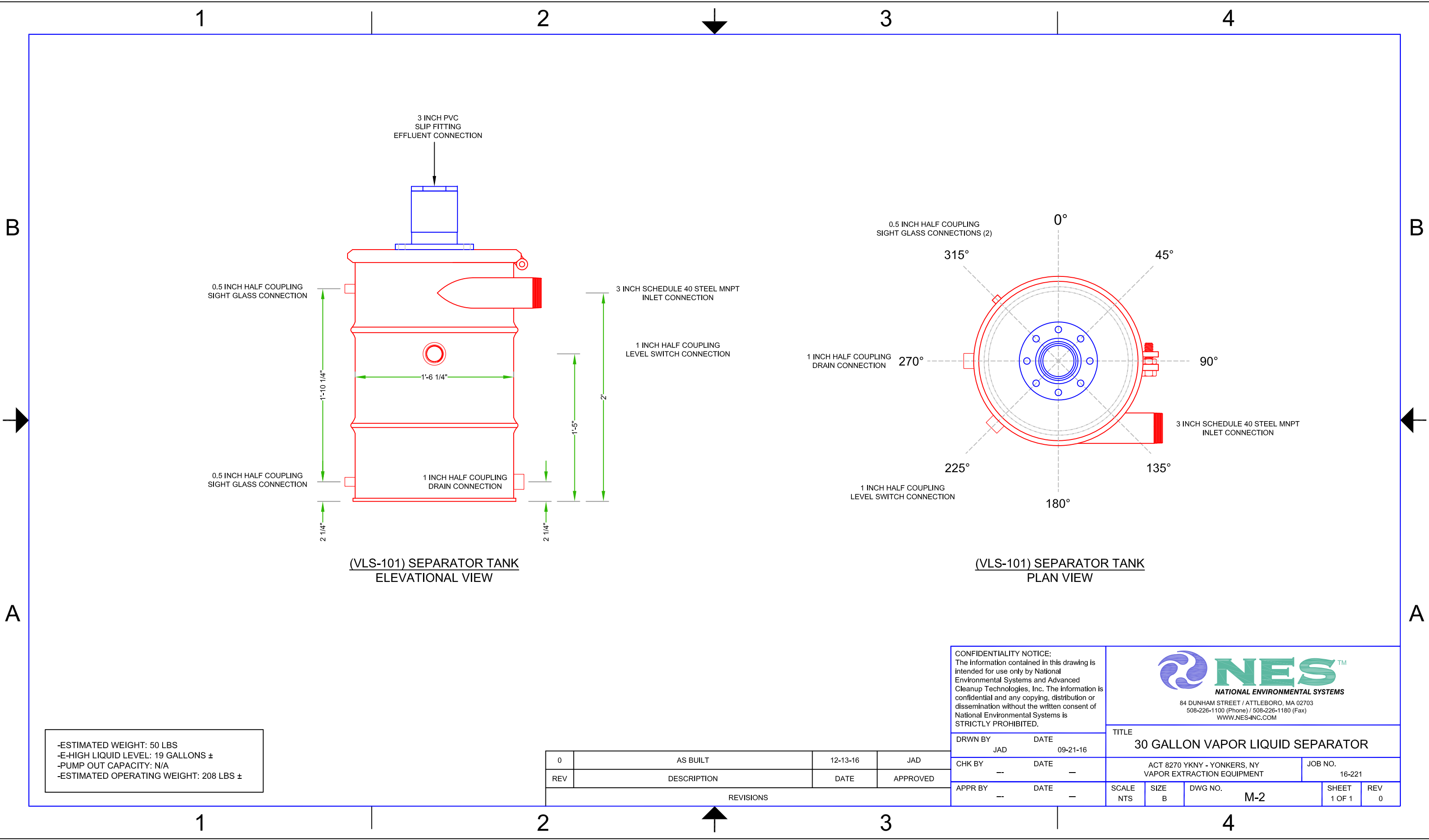
| Model  | Maximum flow<br>m³/h |                   | Installed power<br>kW |                   | Maximum differential pressure<br>Δp hPa (mbar) |                   | Noise level<br>Lp dB (A)<br>(1) |                   | Overall dimensions<br>H (max)<br>mm | Weight<br>(max)<br>Kg |
|--------|----------------------|-------------------|-----------------------|-------------------|------------------------------------------------|-------------------|---------------------------------|-------------------|-------------------------------------|-----------------------|
|        | 50 Hz<br>2900 rpm    | 60 Hz<br>3500 rpm | 50 Hz<br>2900 rpm     | 60 Hz<br>3500 rpm | 50 Hz<br>2900 rpm                              | 60 Hz<br>3500 rpm | 50 Hz<br>2900 rpm               | 60 Hz<br>3500 rpm |                                     |                       |
| K03-MS | 74                   | 89                | 0.37                  | 0.43              | 130                                            | 120               | 59.7                            | 61.7              | 241                                 | 11.0                  |
|        |                      |                   | 0.55                  | 0.63              | 180                                            | 200               | 60.0                            | 62.0              | 241                                 | 12.0                  |
| K04-MS | 137                  | 166               | 0.75                  | 0.9               | 140                                            | 120               | 62.6                            | 64.6              | 282                                 | 15.8                  |
|        |                      |                   | 1.1                   | 1.3               | 200                                            | 175               | 62.8                            | 64.8              | 282                                 | 16.5                  |
|        |                      |                   | 1.5                   | 1.75              | 250                                            | 250               | 63.0                            | 65.0              | 310                                 | 19.5                  |
| K05-MS | 219                  | 265               | 1.1                   | 1.3               | 130                                            | 100               | 68.2                            | 70.2              | 307                                 | 22.5                  |
|        |                      |                   | 1.5                   | 1.75              | 175                                            | 160               | 68.5                            | 70.5              | 315                                 | 23.5                  |
|        |                      |                   | 2.2                   | 2.55              | 270                                            | 260               | 68.8                            | 70.8              | 345                                 | 26.5                  |
|        |                      |                   | 3.0                   | 3.45              | 300                                            | 350               | 69.1                            | 71.1              | 375                                 | 30.5                  |
| K06-MS | 304                  | 366               | 2.2                   | 2.55              | 180                                            | 150               | 71.0                            | 73.0              | 400                                 | 31.2                  |
|        |                      |                   | 3.0                   | 3.45              | 250                                            | 220               | 71.3                            | 73.3              | 400                                 | 32.5                  |
|        |                      |                   | 4.0                   | 4.6               | 340                                            | 325               | 71.6                            | 73.6              | 400                                 | 41.0                  |

(1) Noise measured at 1 m distance with inlet and outlet ports piped, in accordance to ISO 3744.

- For proper use, the blower should be equipped with inlet filter and safety valve; other accessories available on request.
- Ambient temperature from -15° to +40°C.
- Specifications subject to change without notice.



Curves refer to air at 20°C temperature and 1013 mbar (abs) atmospheric pressure measured at inlet port.  
 Values for flow, power consumption and temperature rise: +/-10% tolerance.  
 Data can change without prior notice.



-ESTIMATED WEIGHT: 50 LBS  
-E-HIGH LIQUID LEVEL: 19 GALLONS ±  
-PUMP OUT CAPACITY: N/A  
-ESTIMATED OPERATING WEIGHT: 208 LBS ±

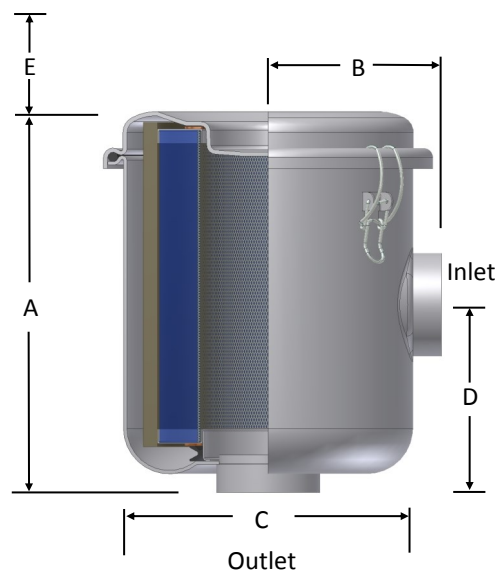
|           |             |          |          |
|-----------|-------------|----------|----------|
| 0         | AS BUILT    | 12-13-16 | JAD      |
| REV       | DESCRIPTION | DATE     | APPROVED |
| REVISIONS |             |          |          |

|                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                           |                                                           |           |                   |                 |          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|-----------|-------------------|-----------------|----------|
| <div>CONFIDENTIALITY NOTICE:<br/>The information contained in this drawing is<br/>intended for use only by National<br/>Environmental Systems and Advanced<br/>Cleanup Technologies, Inc. The information is<br/>confidential and any copying, distribution or<br/>dissemination without the written consent of<br/>National Environmental Systems is<br/>STRICTLY PROHIBITED.</div> | <div><div><b>NES</b><sup>TM</sup><br/>NATIONAL ENVIRONMENTAL SYSTEMS</div></div> <div>84 DUNHAM STREET / ATTLEBORO, MA 02703<br/>508-226-1100 (Phone) / 508-226-1180 (Fax)<br/>WWW.NES-INC.COM</div> |                                                           |           |                   |                 |          |
|                                                                                                                                                                                                                                                                                                                                                                                      | TITLE<br>30 GALLON VAPOR LIQUID SEPARATOR                                                                                                                                                                                                                                                 |                                                           |           |                   |                 |          |
|                                                                                                                                                                                                                                                                                                                                                                                      | DRWN BY<br>JAD                                                                                                                                                                                                                                                                            | DATE<br>09-21-16                                          |           |                   |                 |          |
| CHK BY<br>---                                                                                                                                                                                                                                                                                                                                                                        | DATE<br>---                                                                                                                                                                                                                                                                               | ACT 8270 YKNY - YONKERS, NY<br>VAPOR EXTRACTION EQUIPMENT |           | JOB NO.<br>16-221 |                 |          |
| APPR BY<br>---                                                                                                                                                                                                                                                                                                                                                                       | DATE<br>---                                                                                                                                                                                                                                                                               | SCALE<br>NTS                                              | SIZE<br>B | DWG NO.<br>M-2    | SHEET<br>1 OF 1 | REV<br>0 |



# "L" Style Compact Vacuum Filters

## CSL Series 3/8" - 3"



### Features

- Seamless drawn housings
- O-ring seal
- Corrosion resistant carbon steel construction
- Powder coat finish
- Stainless steel torsion clips for durability

### Technical Specifications

- Vacuum Rating: Medium vacuum service\*\*
- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20" H<sub>2</sub>O over initial Δ P
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

\*\* See Vacuum Filter Technical Data for vacuum service data.

### Benefits

- Large dirt holding capacity and easy field cleaning, especially when mounted horizontally or inverted
- Low pressure design

### Options



- Vacuum gauge
- Higher holding capacity configurations available (select models)
- Material/Finishes: stainless steel, epoxy coating
- Support brackets
- Alternative top-to-canister fastening system for low pressure or pulsating systems
- Stainless steel (select models)

| Inlet/<br>Outlet<br>Size | Assembly<br>Type | SCFM<br>Rating | Housing<br>Config. | Assembly Part Number |                | Dimensions - inches |         |        |         | Suggested<br>Service HT. | Approx.<br>Wt. lbs | Replacement<br>Element Part No. |       | Element<br>SCFM<br>Rating |
|--------------------------|------------------|----------------|--------------------|----------------------|----------------|---------------------|---------|--------|---------|--------------------------|--------------------|---------------------------------|-------|---------------------------|
|                          |                  |                |                    | Polyester            | Paper          | A                   | B       | C      | D       |                          |                    | Polyester                       | Paper |                           |
| 3/8"                     | BSPP             | 18             | A                  | CSL-825-039HCB       | CSL-824-039HCB | 3 3/8               | 2 1/8   | 3 3/4  | 1 13/16 | 3                        | 0.88               | 825                             | 824   | 25                        |
| 1/2"                     | NPSC             | 18             | A                  | CSL-825-050HCB       | CSL-824-050HCB | 3 1/2               | 2 1/4   | 3 3/4  | 2       | 3                        | 0.88               | 825                             | 824   | 25                        |
| 1/2"                     | NPSC             | 20             | B                  | CSL-843-050HC        | CSL-842-050HC  | 4                   | 3       | 5 3/4  | 2 1/2   | 3                        | 3                  | 843                             | 842   | 55                        |
| 3/4"                     | NPSC             | 24             | A                  | CSL-825-075HCB       | CSL-824-075HCB | 3 1/2               | 2 5/16  | 3 3/4  | 2       | 3                        | 0.88               | 825                             | 824   | 25                        |
| 3/4"                     | NPSC             | 25             | B                  | CSL-843-075HC        | CSL-842-075HC  | 4                   | 3       | 5 3/4  | 2 1/2   | 3                        | 3                  | 843                             | 842   | 55                        |
| 1"                       | NPSC             | 35             | B                  | CSL-843-100HC        | CSL-842-100HC  | 4 1/4               | 3 1/4   | 5 3/4  | 2 5/8   | 3                        | 3                  | 843                             | 842   | 55                        |
| 1"                       | NPSC             | 40             | C                  | CSL-849-100HC        | CSL-848-100HC  | 6 11/16             | 4 1/8   | 7 3/8  | 4 1/2   | 5                        | 5                  | 849                             | 848   | 115                       |
| 1 1/4"                   | NPSC             | 55             | B                  | CSL-843-125HC        | CSL-842-125HC  | 4 1/4               | 3 1/4   | 5 3/4  | 2 5/8   | 3                        | 3                  | 843                             | 842   | 55                        |
| 1 1/4"                   | NPSC             | 60             | C                  | CSL-849-125HC        | CSL-848-125HC  | 6 11/16             | 4 1/8   | 7 3/8  | 4 1/2   | 5                        | 5                  | 849                             | 848   | 115                       |
| 1 1/2"                   | NPSC             | 80             | C                  | CSL-849-150HC        | CSL-848-150HC  | 6 3/4               | 4 1/8   | 7 3/8  | 4 1/2   | 5                        | 5                  | 849                             | 848   | 115                       |
| 2"                       | NPSC             | 175            | D                  | CSL-851-200HC        | CSL-850-200HC  | 10 1/4              | 4 1/2   | 8 3/4  | 5       | 9                        | 15                 | 851                             | 850   | 290                       |
| 2 1/2"                   | FPT              | 210            | D                  | CSL-851-250HC        | CSL-850-250HC  | 10 11/16            | 5 1/8   | 8 3/4  | 5 1/2   | 9                        | 15                 | 851                             | 850   | 290                       |
| 3"                       | FPT              | 300            | E                  | CSL-239-300C         | CSL-238-300C   | 15 3/4              | 8 13/16 | 13 1/4 | 8 11/16 | 11                       | 33                 | 239                             | 238   | 570                       |

See Vacuum Filter Technical Data section for sizing guidelines.

Note: Model offerings and design parameters may change without notice. See [www.solbergmfg.com](http://www.solbergmfg.com) for most current offering.



**SOLBERG**



## **Inlet Vacuum Filters Maintenance Manual**

**[www.solbergmfg.com](http://www.solbergmfg.com)**

Note: Please read the maintenance instructions given by the OEM for the machinery first. The OEM's manual should be adhered to in order to protect the equipment. Solberg Manufacturing, Inc has made every effort to make sure that these instructions are accurate but is not responsible for any typos, slight variations or for human errors that may occur.

# Maintenance Manual

## **SOLBERG Inlet Vacuum Filters**

### **CONTENTS**

#### **Section A**

|                    |       |
|--------------------|-------|
| Introduction ..... | pg. 3 |
|--------------------|-------|

#### **Section B**

##### General Information

|                                            |       |
|--------------------------------------------|-------|
| 1. Identification of Solberg Filters ..... | pg. 3 |
| 2. Filtration Rules of Thumb .....         | pg. 4 |
| 3. Element Specifications .....            | pg. 6 |
| 4. Element Cleaning .....                  | pg. 7 |

#### **Section C**

##### Procedures

|                                                   |       |
|---------------------------------------------------|-------|
| 1. Installation .....                             | pg. 8 |
| 2. Disconnecting Canister Top from Base .....     | pg. 8 |
| 3. Removing Element for Service/Maintenance. .... | pg. 8 |
| 4. Securing Element .....                         | pg. 9 |
| 5. Securing Canister Top to Canister Base. ....   | pg. 9 |

#### **Section D**

##### Maintenance Recommendations

|                           |        |
|---------------------------|--------|
| 1. General .....          | pg. 10 |
| 2. Spare Parts List ..... | pg. 10 |

***\*For Further Information Please Call: 630-773-1363***



## Section A

### **INTRODUCTION**

The purpose of this manual is instruction on the proper assembly and care of Solberg inlet vacuum filters.

## **\*WARNING\***

**This manual must be read and thoroughly understood before using and caring for this air filter. Failure to comply could result in explosion, product/system contamination or personal injury.**

This manual should be used as a supplement to the user's understanding of the proper care needed to maintain a safe and dependable air filter. It is the responsibility of the user to interpret and explain all instructions to persons who do not read or understand English BEFORE they are allowed to maintain and use this filter.

This manual should be readily available to all operators responsible for operation and maintenance of the vacuum inlet filters.

We thank you for selecting products from Solberg Manufacturing, Inc. We are confident that our superior filter designs will exceed your application requirements.

## Section B

### **GENERAL INFORMATION**

#### **1. Identification of Solberg Vacuum Inlet Filters.**

All Solberg inlet vacuum air filters should have an identification label/nameplate that gives the following information:

**Assembly Model #**  
**Replacement Element #**

(The exception is OEM supplied units. In this case please enter the OEM part numbers below.)

**Page 3**

Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA  
Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com  
Rev: MMVF-910



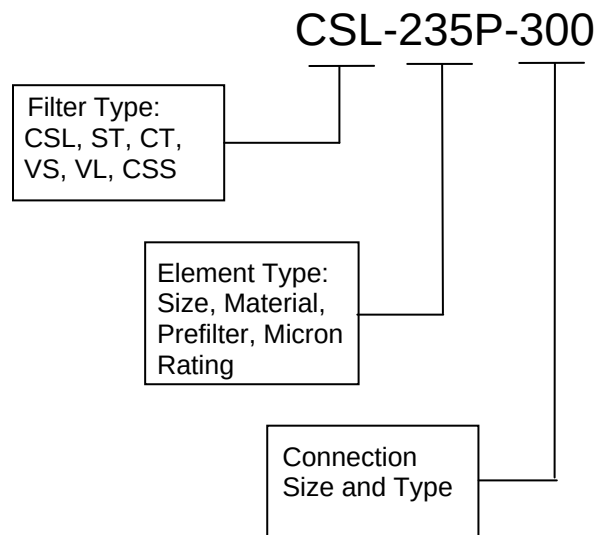
**SOLBERG**

Fill in the actual nameplate data from your new Solberg inlet filter(s):

| No. | Filter Model Number | Replacement Element |
|-----|---------------------|---------------------|
| 1   |                     |                     |
| 2   |                     |                     |
| 3   |                     |                     |
| 4   |                     |                     |
| 5   |                     |                     |

Table 1

The model number designates the filter type, the original element configuration and housing connection size. For example, the following part number identifies the filter as being a 'CSL' design filter with a 235 element with prefilter and 3" MPT connection size:



## 2. Filtration Rules of Thumb

**General:** For peak output performance from a compressor, blower, vacuum pump, engine, or any other machine that consumes air, one must have clean, unrestricted air. Proper filtration can help stabilize the working environment within rotating equipment even when the external conditions may be quite severe. A critical component in creating the right working conditions is filter sizing. With the properly sized filter, equipment will run smoothly over its entire expected operating life.

A major factor in filtration and filter sizing is air velocity through the filter media. Generally, the slower the velocity of air through a media the higher the filter efficiency and, conversely, the lower the pressure drop. Therefore, the primary



goal in filter sizing is to optimize the velocity of air through the media (sometimes called face velocity).

**Rule of Thumb #1:** Always begin with the filter cartridge requirements when sizing a filter. Once the appropriate element has been selected then move on to the housing requirements.

**Rule of Thumb #2:** Always ask or specify a filter based on a micron rating **with** filtration efficiencies. As an example, stating a requirement for a 1-micron filter is misleading because no efficiency rating has been specified. A 1-micron filter at 95-% efficiency may be less efficient than a 5-micron filter at 99% efficiency. For proper air system performance in light and industrial duty environments, a filter with a minimum of 99% filtration efficiency at 5 microns is required.

**Rule of Thumb #3:** Size your filter correctly by understanding the impact air velocity through a media has on efficiency and pressure drop. Maintain the suggested Air-to-Media ratios listed below based on the external environment listings and Filtration efficiency needs.

| Filtration Efficiency Requirements<br>(99+% efficiency)           | Environmental Conditions                       | Air to Media Ratio     |                                         |
|-------------------------------------------------------------------|------------------------------------------------|------------------------|-----------------------------------------|
|                                                                   |                                                | CFM/ft <sup>2</sup>    | (m <sup>3</sup> /h)/cm <sup>2</sup>     |
| <i>Industrial Grade 2-micron Paper</i>                            | Industrial Duty (clean, office/warehouse-like) | 30 CFM/ft <sup>2</sup> | (51m <sup>3</sup> /h)/cm <sup>2</sup>   |
|                                                                   | Severe Duty (workshop, factory-like)           | 15 CFM/ft <sup>2</sup> | (25.5m <sup>3</sup> /h)/cm <sup>2</sup> |
|                                                                   | Extreme Duty (Foundry, Construction-like)      | 10 CFM/ft <sup>2</sup> | (17m <sup>3</sup> /h)/cm <sup>2</sup>   |
| <i>Industrial Grade 5-micron Polyester</i>                        | Industrial Duty (clean, office/warehouse-like) | 50 CFM/ft <sup>2</sup> | (85m <sup>3</sup> /h)/cm <sup>2</sup>   |
|                                                                   | Severe Duty (workshop, factory-like)           | 40 CFM/ft <sup>2</sup> | (68m <sup>3</sup> /h)/cm <sup>2</sup>   |
|                                                                   | Extreme Duty (Foundry, Construction-like)      | 25 CFM/ft <sup>2</sup> | (42.5m <sup>3</sup> /h)/cm <sup>2</sup> |
| <i>Industrial Grade 1-micron Polyester</i>                        | Severe Duty (Foundry, Construction-like)       | 10 CFM/ft <sup>2</sup> | (17m <sup>3</sup> /h)/cm <sup>2</sup>   |
| <i>Industrial Grade 0.3-micron HEPA Glass @ 99.97% efficiency</i> | Industrial Duty (clean office/warehouse-like)  | 10 CFM/ft <sup>2</sup> | (17m <sup>3</sup> /h)/cm <sup>2</sup>   |
|                                                                   | Severe Duty (workshop, factory-like)           | 7 CFM/ft <sup>2</sup>  | (12m <sup>3</sup> /h)/cm <sup>2</sup>   |
|                                                                   | Extreme Duty (Foundry, Construction-like)      | 5 CFM/ft <sup>2</sup>  | (8.5m <sup>3</sup> /h)/cm <sup>2</sup>  |

Table 2



**Rule of Thumb #4:** Pressure drop is also caused by the dirt holding capacity of the element. As the element fills up with dirt, the pressure drop increases. It is important to document the pressure drop across a given filter when it is new and then clean or replace it when the pressure drop increases by 10" to 15" / 250-380mm H<sub>2</sub>O from the original reading.

**Rule of Thumb #5:** The inlet connection greatly influences the overall pressure drop of the filter system. To minimize the restriction contributed by an inlet filter, a velocity of 6,000 ft/min (10200m<sup>3</sup>/h) or less is suggested through the outlet pipe. The table below lists the suggested flows based on pipe size:

| Pipe Size (inches) | Max Airflow |                     | Pipe Size (inches) | Max Airflow |                       | Pipe Size (inches) | Airflow   |                        |
|--------------------|-------------|---------------------|--------------------|-------------|-----------------------|--------------------|-----------|------------------------|
| 1/4"               | 6 CFM       | 10m <sup>3</sup> /h | 1 ¼"               | 60 CFM      | 102m <sup>3</sup> /h  | 6"                 | 1,100 CFM | 1870m <sup>3</sup> /h  |
| 3/8"               | 8 CFM       | 14m <sup>3</sup> /h | 1 ½"               | 80 CFM      | 136m <sup>3</sup> /h  | 8"                 | 1,800 CFM | 3060m <sup>3</sup> /h  |
| 1/2"               | 10 CFM      | 17m <sup>3</sup> /h | 2"                 | 135 CFM     | 230m <sup>3</sup> /h  | 10"                | 3,300 CFM | 5610m <sup>3</sup> /h  |
| 3/4"               | 20 CFM      | 34m <sup>3</sup> /h | 2 ½"               | 195 CFM     | 332m <sup>3</sup> /h  | 12"                | 4,700 CFM | 7990m <sup>3</sup> /h  |
| 1"                 | 35 CFM      | 60m <sup>3</sup> /h | 3"                 | 300 CFM     | 510m <sup>3</sup> /h  | 14"                | 6,000 CFM | 10200m <sup>3</sup> /h |
|                    |             |                     | 4"                 | 520 CFM     | 884m <sup>3</sup> /h  |                    |           |                        |
|                    |             |                     | 5"                 | 800 CFM     | 1360m <sup>3</sup> /h |                    |           |                        |

Table 3 \*Note: This information is for general use only. A qualified engineer must properly design each system.

### 3. Element Specifications

Temperature Range: -15° to 220°F / -26° to 105°C

Filter Change-Out Differential: 10" to 15" / 250-380mm H<sub>2</sub>O Over Initial Delta P

| Media                    | Micron Rating             |
|--------------------------|---------------------------|
| Standard Paper           | 99+% @ 2 micron           |
| Standard Polyester       | 99+% @ 5 micron           |
| "S" Series Wire Mesh     | Epoxy Coated Wire Mesh    |
| "Z" Series Polyester     | 99+% @ 1 micron           |
| "HE" Series HEPA         | 99.97% @ 0.3 microns      |
| "U" Series Polyester     | 99+% @ 25 micron          |
| "W" Series Polyester     | 99+% @ 100 micron         |
| "S2" Series              | Stainless Steel Wire Mesh |
| "AC" & "ACP" Series      | N/A                       |
| "Y" Series Polypropylene | 99+% @ 5 micron           |

Table 4





Temperature Range: -15° to 385°F / -26° to 196°C

Filter Change-Out Differential: 10" to 15" / 250-380mm H<sub>2</sub>O Over Initial Delta P

| Media                             | Micron Rating   |
|-----------------------------------|-----------------|
| "MX" & "MXD" Series – Nomex Cloth | 99+% @ 5 micron |

Table 5

#### 4. Element Cleaning - Inlet Filtration

Solberg elements should be cleaned or replaced, once the pressure drop reaches 15 to 20-inches water column (380 - 500mm WC) above the initial pressure drop of the installation.

The decision to clean the element rather than replace it is left to the discretion of the operator. Any damage which results from by-pass or additional pressure drop created by element cleaning is the sole responsibility of the operator.

### **\*WARNING\***

The overall performance of a filter element is altered once cleaned.

The initial pressure drop after cleaning will be greater than the original, clean pressure drop of the element.

After each subsequent cleaning, the initial pressure drop will continue to increase.

Under all circumstances, the initial pressure drop of the element needs to be maintained at less than 20-inches water column (500mm WC).

Cleaned elements that exceed 20-inches water column (500mm WC) at start-up should be replaced with new elements.

With many types of equipment, the maximum pressure drop allowed will be dictated by the ability of the equipment to perform to its rated capacity. Under all





circumstances, the operator should avoid exceeding the manufacturer's recommended maximum pressure drop for their specific equipment.

- A. **Polyester Element:** The polyester element may be washed in warm soapy water, vacuumed, gently blown out or replaced. The element should be dry before reinstallation. The element should be replaced after a maximum of three cleanings.
- B. **Paper Element:** The paper element may be lightly blown with low pressure air. It is disposable and in most cases should be replaced with a new element.
- C. **Polyurethane Prefilter:** The prefilter may be washed as a sponge or replaced to give the element a longer service life.
- D. **Epoxy Coated Wire Mesh and Stainless Steel Wire Mesh Elements:** Cleaning instructions similar to polyester, except mild solvents may be used.
- E. **Activated Carbon Element:** Not cleanable
- F. **Polypropylene Element:** Cleaning instructions similar to polyester
- G. **Nomex Cloth Element:** Cleaning instructions similar to polyester

If you are not confident that the integrity of the element was maintained during cleaning, it is recommended that a new element be installed. Also, spare parts such as gaskets, wing nuts and washers can be supplied upon request.

## Section C

### **PROCEDURES**

#### **1. Installation.**

- A. Maximum inlet gas stream temperature for most Solberg inlet vacuum filter products is 220°F / 105°C. Temperatures in excess of this could cause damage to elements, media and elastomers.
- B. Direction of flow is typically from the outside of the element to the inside of the element. Most products have arrows indicating direction of flow on inlet and outlet ports.
- C. Ensure that pipe/flange connections are adequately sealed so the potential for leaks is reduced to a minimum.

#### **2. Disconnecting canister top from canister base.**

- A. ST/CT/Small CSL: Release wire-form clips or loosen wing nut on "claw" bolts.



- B. Large CSL: Loosen wing nut or hex head on T-bolts.
- C. CSS: Twist upper housing to release.
- D. VS/VL: Remove V-clamp by loosening Hex Nut or T-bolt and releasing.
- E. Lift off canister top.

### **3. Removing element for service/maintenance.**

- A. Remove retaining hex head/wing-nut and washer carefully, and then remove element. Some elements will have a top plate that should also be removed.
- B. Clean sealing surfaces of housing, top & base plates, and element endcaps so that they are free of dirt or any other particulate.

## **\*WARNING\***

**Failure to comply with these instructions  
may result in system or pump contamination.**

### **4. Securing Element.**

- A. Place new or cleaned element evenly on base plate. Be sure element seats properly on base and there is no dirt or particulate present on sealing surfaces.
- B. Place top plate (if necessary) on element by centering on tap bolt.
- C. Secure washer and wing nut to end cap (or top plate) and tap bolt. Element must be tightly secured. Note: DO NOT over tighten!

## **\*WARNING\***

**Defective installation may cause system or  
pump contamination. Use only genuine  
Solberg replacement parts.**

### **5. Securing canister top to canister base.**

- A. Make sure all surfaces are free from dust and other particulate.

**Page 9**

*Solberg Manufacturing, Inc., 1151 Ardmore Itasca, IL 60143 USA  
Ph: 630.773.1363 Fax: 630.773.0727 Email: sales@solbergmfg.com Web: www.solbergmfg.com  
Rev: MMVF-910*



**SOLBERG**

- B. Hemisphere o-ring must rest evenly along canister/casting base o-ring groove.
- C. ST/CT/Small CSL: Hold canister housing against o-ring or sealing ring on main filter head. Re-fasten wire-form clips or "claw" bolts.
- D. Large CSL: Replace housing top plate. Feed T-bolts into corresponding slots and tighten evenly around perimeter. Note: Do NOT over tighten!
- E. VS/VL: Secure V-clamp by disconnecting hex nut or T-bolt portion and placing V-clamp along the diameter of canister o-ring groove. Fasten T-bolt and secure tightly. V-CLAMP LEGS MUST REST UNIFORMLY ALONG ENTIRE O-RING GROOVE.
- F. CSS: Reassemble top housing to bottom housing by aligning tabs and turning into place.

## **Section D**

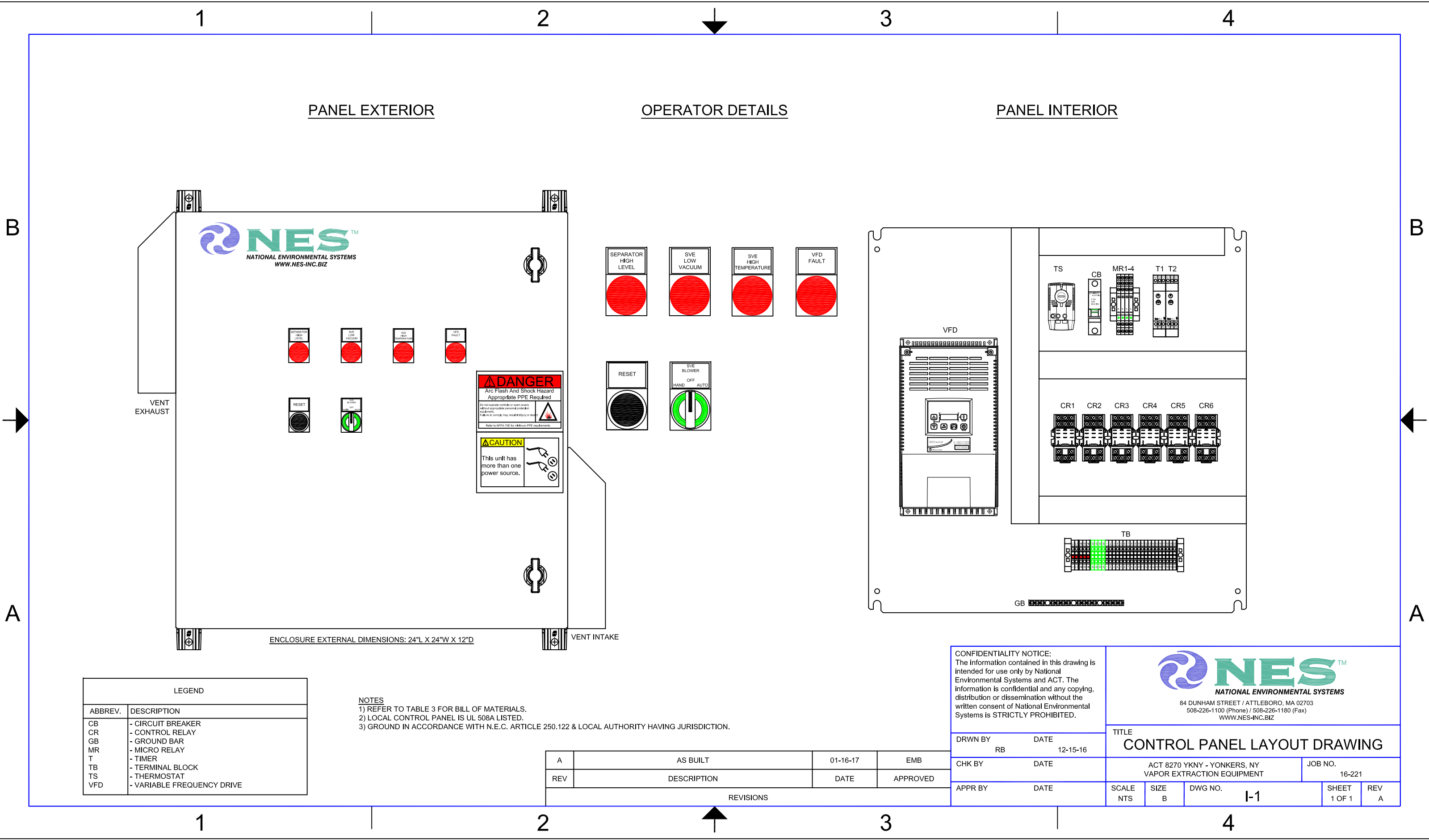
### **MAINTENANCE RECOMMENDATIONS**

1. Pressure drop readings are recommended to have an effective air filter. Always document initial pressure drop during start-up when element is clean. Replacement cartridge is needed when system experiences 10" to 15" / 250-380mm H<sub>2</sub>O higher pressure drop above the initial reading. Refer to page 4 for instructions.
2. Always check replacement cartridge gaskets to insure they are adhered uniformly along the end caps during handling. If not, contact Solberg Manufacturing, Inc. immediately. Do not modify or change from Solberg specified parts!
3. Always check inlets/outlets, element base and its components when replacing element to insure cleanliness. Wipe clean if necessary.
4. Operate only when a proper seal exists.
5. VS/VL: Never operate without absolute assurance that V-clamp is secured correctly along entire diameter of canisters. Check along V-clamp for wear. Replace if any distortion occurs due to handling and usage.

### **SPARE PARTS**

Contact your Solberg Representative for spare part model numbers.





| LEGEND  |                            |
|---------|----------------------------|
| ABBREV. | DESCRIPTION                |
| CB      | - CIRCUIT BREAKER          |
| CR      | - CONTROL RELAY            |
| GB      | - GROUND BAR               |
| MR      | - MICRO RELAY              |
| T       | - TIMER                    |
| TB      | - TERMINAL BLOCK           |
| TS      | - THERMOSTAT               |
| VFD     | - VARIABLE FREQUENCY DRIVE |

NOTES  
1) REFER TO TABLE 3 FOR BILL OF MATERIALS.  
2) LOCAL CONTROL PANEL IS UL 508A LISTED.  
3) GROUND IN ACCORDANCE WITH N.E.C. ARTICLE 250.122 & LOCAL AUTHORITY HAVING JURISDICTION.

| A         | AS BUILT    | 01-16-17 | EMB      |
|-----------|-------------|----------|----------|
| REV       | DESCRIPTION | DATE     | APPROVED |
| REVISIONS |             |          |          |

CONFIDENTIALITY NOTICE:  
The information contained in this drawing is intended for use only by National Environmental Systems and ACT. The information is confidential and any copying, distribution or dissemination without the written consent of National Environmental Systems is STRICTLY PROHIBITED.

|         |          |
|---------|----------|
| DRWN BY | DATE     |
| RB      | 12-15-16 |
| CHK BY  | DATE     |
| APPR BY | DATE     |



NATIONAL ENVIRONMENTAL SYSTEMS  
84 DUNHAM STREET / ATTLEBORO, MA 02703  
508-226-1100 (Phone) / 508-226-1180 (Fax)  
WWW.NES-INC.BIZ

TITLE  
**CONTROL PANEL LAYOUT DRAWING**

|                                                           |           |                   |
|-----------------------------------------------------------|-----------|-------------------|
| ACT 8270 YKNY - YONKERS, NY<br>VAPOR EXTRACTION EQUIPMENT |           | JOB NO.<br>16-221 |
| SCALE<br>NTS                                              | SIZE<br>B | DWG NO.<br>I-1    |
| SHEET<br>1 OF 1                                           | REV<br>A  |                   |



TABLE 3  
PANEL BILL OF MATERIALS

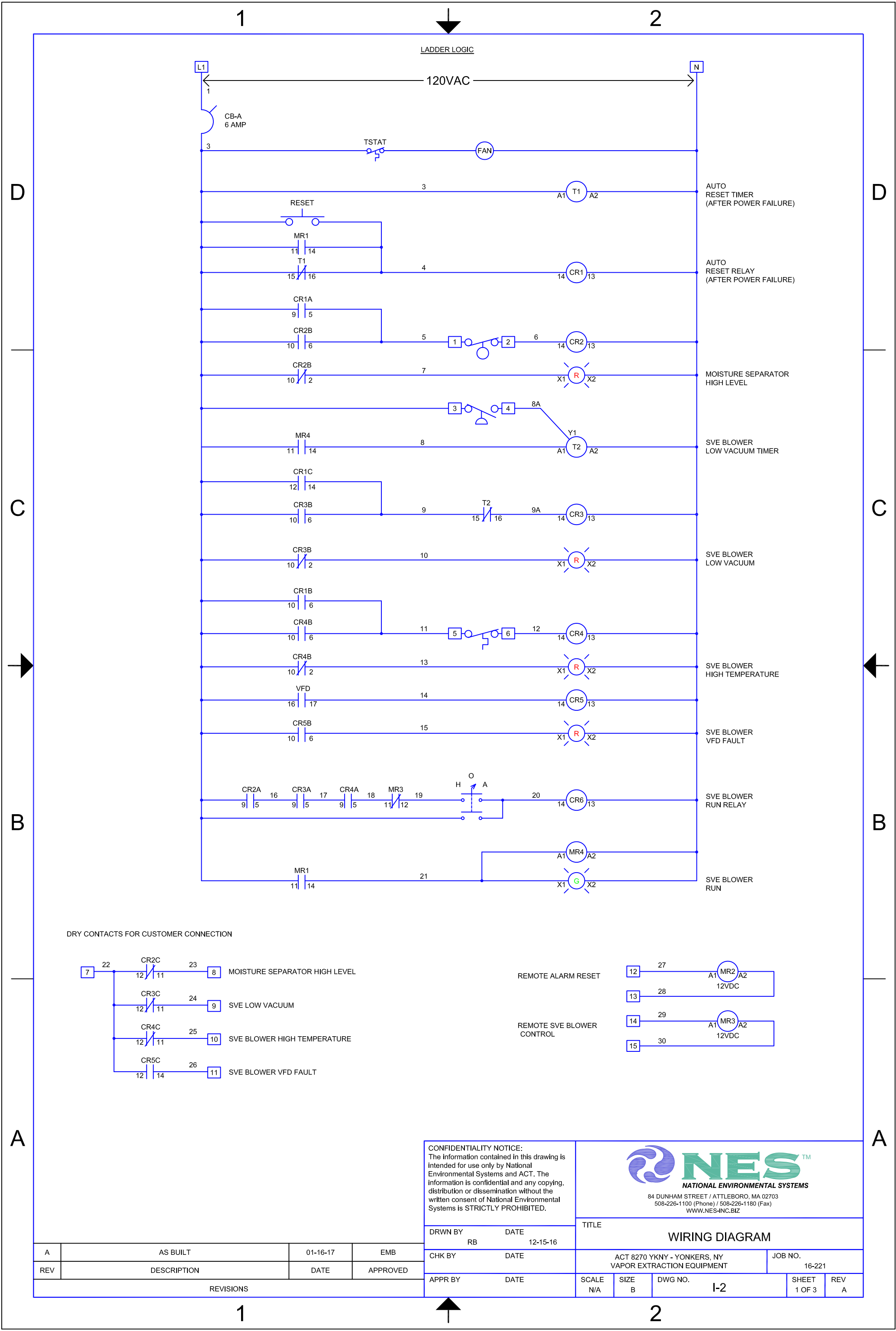
REVISION A

JANUARY 2017

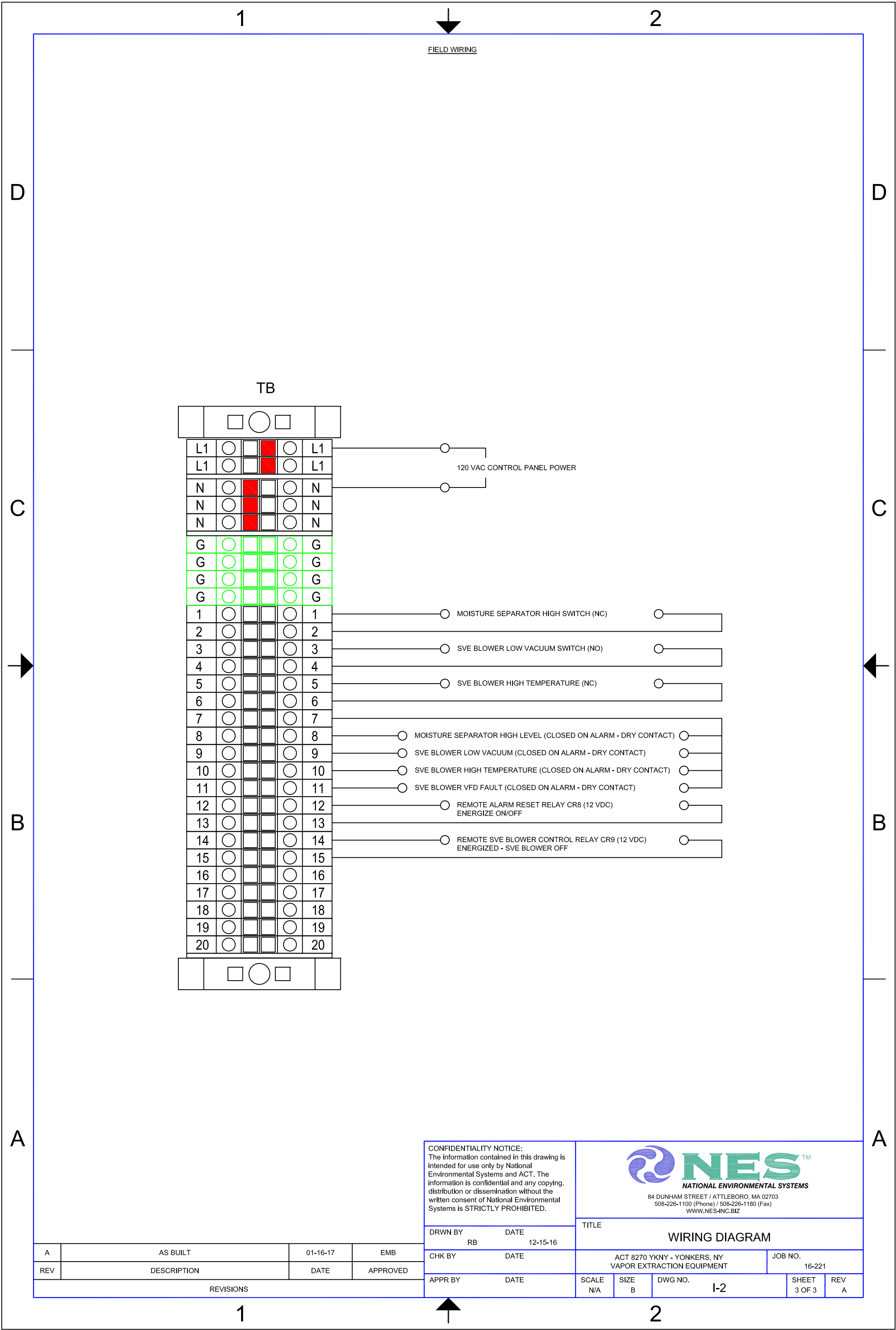
16-221

ACT 8270 YKNY - YONKERS, NY / VAPOR EXTRACTION EQUIPMENT

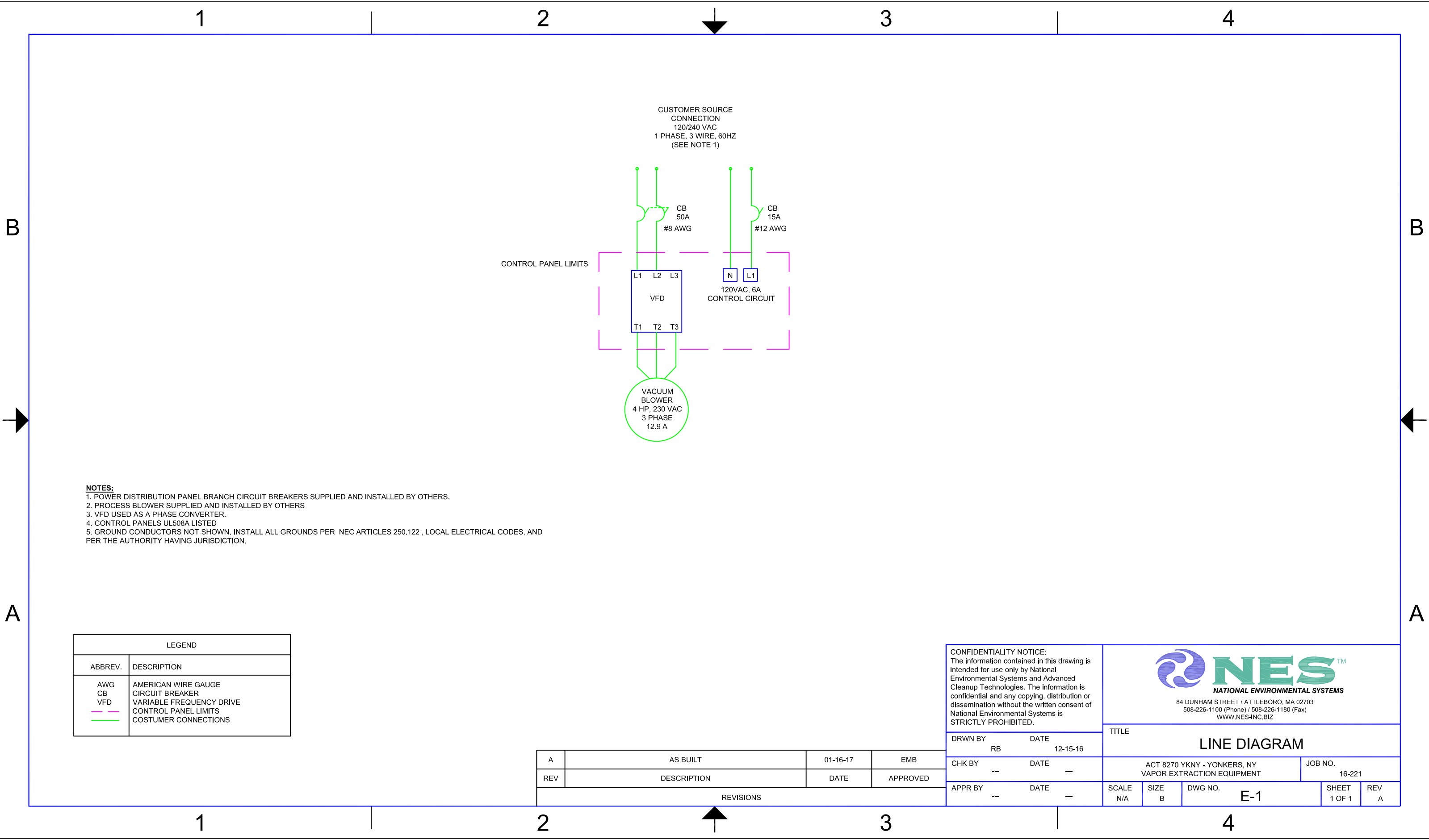
| TAG   | QUANTITY | ITEM                                                         | MODEL           | MANUFACTURER |
|-------|----------|--------------------------------------------------------------|-----------------|--------------|
| ENCL  | 1        | CONTROL PANEL ENCLOSURE 24 X 24 X 12 - MILD STEEL/GRAY       | EN4SD242412GY   | HAMMOND      |
| ENCL  | 1        | BACK-PANEL, 24 X 24 - STEEL/WHT                              | EP2424          | HAMMOND      |
| ENCL  | 1        | MOUNTING FEET SET OF 4 - ZINC PLATED                         | EZPMFHD         | HAMMOND      |
| VF    | 1        | VENT FAN 105CFM 115VAC 4.7" W/ FILTER GRILL 24 IN CORD       | DNFF120BK115    | HAMMOND      |
| VF    | 1        | VENT FAN ADJUSTABLE 30-140F BI-METAL TEMP SWITCH N.O.        | SKT011419NO     | HAMMOND      |
| VF    | 2        | VENT FAN RAINHOOD NEMA 3R                                    | RH20000GY       | HAMMOND      |
| VF    | 2        | VENT FAN GRILL / SOLID COVER KIT                             | RHA20000G       | HAMMOND      |
| CB    | 1        | CIRCUIT BREAKER 6A 1-POLE 120/240 VAC 1-PHASE 10KA DIN-MOUNT | MG24430_        | SQUARE D     |
| VFD   | 1        | VFD, 10 HP 208/230VAC 3-PHASE 33 AMPS                        | ESV752N02TXB    | AC TECH      |
| MR1-3 | 3        | RELAY 1 POLE 6-24VDC                                         | RV8H-L-D24      | IDEC         |
| MR4   | 1        | RELAY 1 POLE 120VAC                                          | RV8H-L-AD110    | IDEC         |
| CR1-6 | 6        | RELAY 3PDT 120VAC W/INDICATOR LIGHT                          | RH3B-UL-AC 120V | IDEC         |
| CR1-6 | 6        | RELAY SOCKET FOR RH3B                                        | SH3B- 05        | IDEC         |
| T     | 2        | TIMER ON-DELAY                                               | RE17RAMU        | SQUARE D     |
| PB    | 6        | LEGEND PLATE HOLDER                                          | ZBZ33           | SQUARE D     |
| LT    | 4        | PILOT LIGHT HEAD, RED                                        | ZB5AV043        | SQUARE D     |
| LT    | 4        | MOUNTING BASE,120V RED PROTECTED LED                         | ZB5AVG4         | SQUARE D     |
| SW    | 1        | PUSH BUTTON OPERATOR NON-ILLUM BLACK                         | ZB5AA2          | SQUARE D     |
| SW    | 1        | 3 POSITION SELECTOR SWITCH ILLUM. GREEN MOMENTARY            | ZB5AK1733       | SQUARE D     |
| SW    | 1        | MOUNTING BASE 120V GREEN PROTECTED LED                       | ZB5AVG3         | SQUARE D     |
| TB    | 25       | TERMINAL BLOCK SCREW CLAMP 20 AMP 600 V GRAY                 | NSYTRV22        | SQUARE D     |
| TB    | 3        | TERMINAL BLOCK END BARRIERS GRAY                             | NSYTRAC22       | SQUARE D     |
| TB    | 2        | TERMINAL BLOCK END ANCHORS                                   | NSYTRAABV35     | SQUARE D     |
| GB    | 1        | LOAD CENTER GROUND BAR 15 TERMINALS                          | PK15GTA         | SQUARE D     |











**NOTES:**  
1. POWER DISTRIBUTION PANEL BRANCH CIRCUIT BREAKERS SUPPLIED AND INSTALLED BY OTHERS.  
2. PROCESS BLOWER SUPPLIED AND INSTALLED BY OTHERS  
3. VFD USED AS A PHASE CONVERTER.  
4. CONTROL PANELS UL508A LISTED  
5. GROUND CONDUCTORS NOT SHOWN. INSTALL ALL GROUNDS PER NEC ARTICLES 250.122 , LOCAL ELECTRICAL CODES, AND PER THE AUTHORITY HAVING JURISDICTION.

| LEGEND  |                          |
|---------|--------------------------|
| ABBREV. | DESCRIPTION              |
| AWG     | AMERICAN WIRE GAUGE      |
| CB      | CIRCUIT BREAKER          |
| VFD     | VARIABLE FREQUENCY DRIVE |
| —       | CONTROL PANEL LIMITS     |
| —       | COSTUMER CONNECTIONS     |

|           |             |          |          |
|-----------|-------------|----------|----------|
| A         | AS BUILT    | 01-16-17 | EMB      |
| REV       | DESCRIPTION | DATE     | APPROVED |
| REVISIONS |             |          |          |

|                                                                                                                                                                                                                                                                                                                                                |                  |                                                                                                                                                                                                 |           |                       |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------------------|-----------------|
| <b>CONFIDENTIALITY NOTICE:</b><br>The information contained in this drawing is intended for use only by National Environmental Systems and Advanced Cleanup Technologies. The information is confidential and any copying, distribution or dissemination without the written consent of National Environmental Systems is STRICTLY PROHIBITED. |                  | <br>84 DUNHAM STREET / ATTLEBORO, MA 02703<br>508-226-1100 (Phone) / 508-226-1180 (Fax)<br>WWW.NES-INC.BIZ |           |                       |                 |
|                                                                                                                                                                                                                                                                                                                                                |                  | TITLE<br><b>LINE DIAGRAM</b>                                                                                                                                                                    |           |                       |                 |
| DRWN BY<br>RB                                                                                                                                                                                                                                                                                                                                  | DATE<br>12-15-16 | ACT 8270 YKNY - YONKERS, NY<br>VAPOR EXTRACTION EQUIPMENT                                                                                                                                       |           | JOB NO.<br>16-221     |                 |
| CHK BY<br>--                                                                                                                                                                                                                                                                                                                                   | DATE<br>--       | SCALE<br>N/A                                                                                                                                                                                    | SIZE<br>B | DWG NO.<br><b>E-1</b> | SHEET<br>1 OF 1 |
| APPR BY<br>--                                                                                                                                                                                                                                                                                                                                  | DATE<br>--       |                                                                                                                                                                                                 |           | REV<br>A              |                 |



**TABLE 5**  
**AC TECH ESV**

**VFD SETTINGS**  
**NES 16-221 REVISION A - (JANUARY, 2017)**  
ACT 8270 YKNY - YONKERS, NY / VAPOR EXTRACTION EQUIPMENT

**SETPOINTS LOADED BY NES - VIA VFD INTEGRAL KEYPAD**

| <b>CODE#</b> | <b>NAME</b>               | <b>SELECTION</b> | <b>DESCRIPTION</b>                 |
|--------------|---------------------------|------------------|------------------------------------|
| P100         | START CONTROL SOURCE      | 1                | TERMINAL STRIP                     |
| P101         | STANDARD REFERENCE SOURCE | 0                | KEYPAD                             |
| P102         | MINIMUM FREQUENCY         | 30               | Hz                                 |
| P104         | ACCELERATION TIME 1       | 3                | SECONDS                            |
| P108         | MOTOR OVERLOAD            | 44               | PERCENTAGE 12.9 / 29 = .4448 (44%) |
| P111         | STOP METHOD               | 0                | COAST                              |
| P140         | RELAY OUTPUT (TB16-17)    | 4                | INVERSE FAULT                      |
| P142         | TB-14 OUTPUT              | 1                | RUN SIGNAL                         |
|              |                           |                  |                                    |
|              |                           |                  |                                    |

PLEASE NOTE: PARAMETERS NOT LISTED REMAIN AT FACTORY DEFAULT

## **Type 4 Mild Steel Wallmount Enclosure** *Eclipse Series*

### **Hinge Door with Quarter Turn/Handle**



### **Application**

- Designed to enclose electrical and/or electronic equipment and protect against harsh, industrial environments for wallmount applications.
- Impressive styling features like hidden hinges, attractive latching systems make the Eclipse a suitable addition to any high-tech equipment installation.
- A wide range of sizes and practical accessories make this product line a complete package.

### **Standards**

- UL 508 Type 3R, 4, and 12
- CSA Type 3R, 4, and 12
- Complies with
  - NEMA Type 3R, 4, and 12
  - IEC 60529, IP66

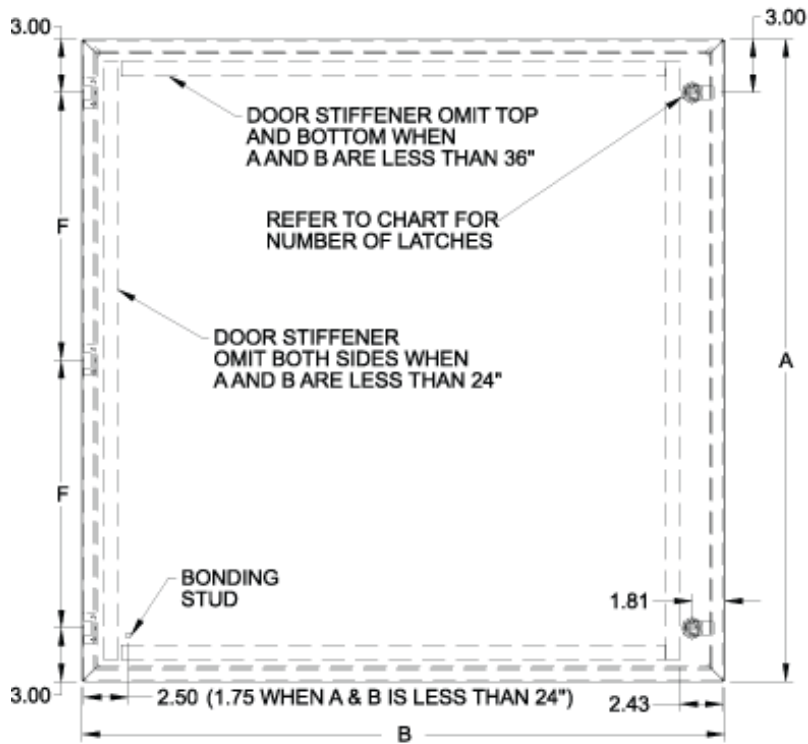
### **Construction**

- Formed 14 or 16 gauge steel.
- Smooth, continuously welded seams ground smooth.
- Door stiffeners are provided where required for increased strength and rigidity - designed to also permit additional mounting options.
- Formed lip on enclosure to exclude flowing liquids and contaminants.
- Door latches feature the added safety of quarter turn slot requiring use of tool for opening.
- Doors may be easily removed for modifications and are interchangeable.
- Seamless poured-in place gasket.
- Collar studs provided for mounting inner panel.
- Includes hardware kit with panel mounting nuts and sealing washers for wall mounting holes.
- Bonding stud provided on door and grounding stud installed in enclosure.
- Hinges are constructed from 304 stainless steel.
- Hinge pins are stainless steel.
- Quarter turn latch and multi-point handle (key lockable) are zinc diecast with black epoxy finish.
- Door alignment guide provided on 36" wide enclosures.

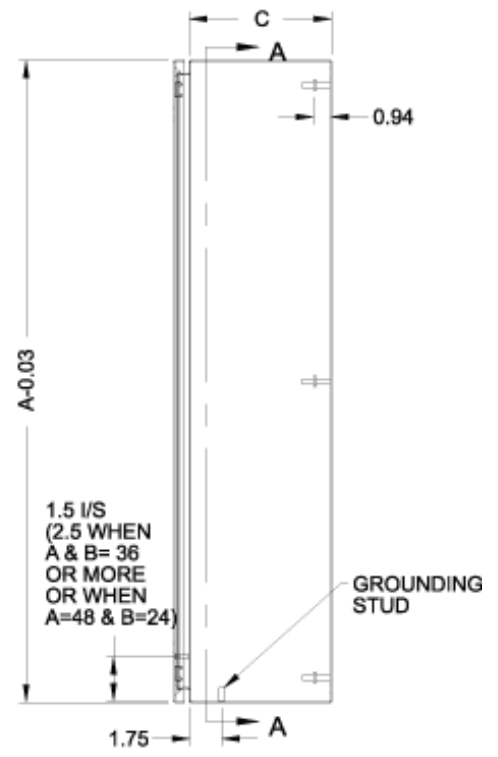
### **Finish**

- Cover and enclosure are phosphatized and finished with a recoatable powder inside and out with choice of ANSI 61 smooth Gray (GY) or RAL7035 textured light gray (LG).

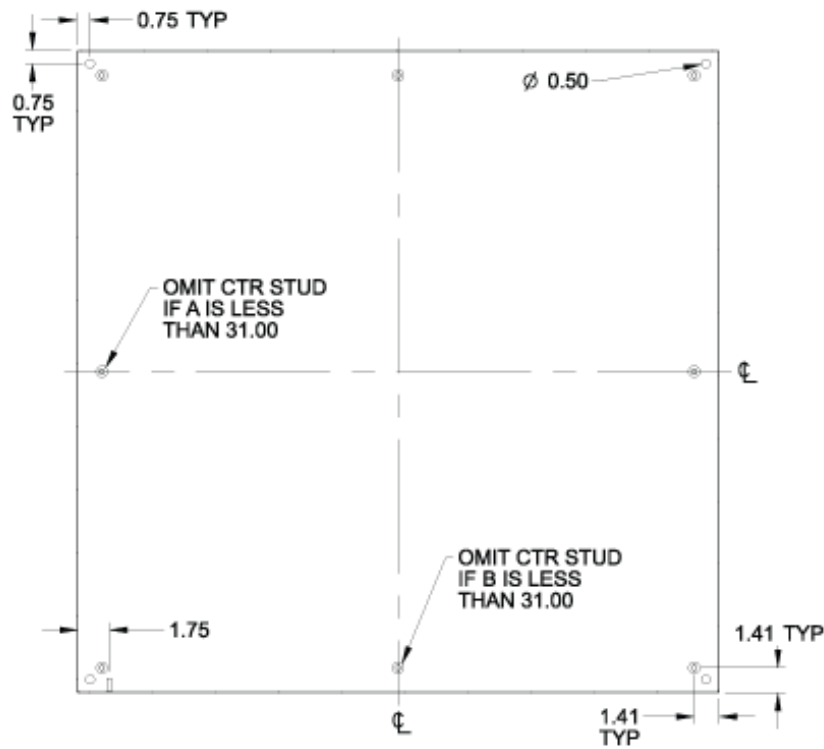
### **Accessories**



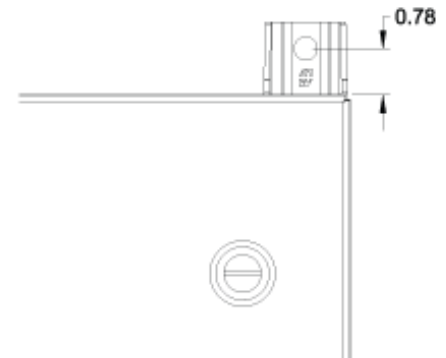
**Front View**



**Side View**



**SECTION A-A**



**Mounting Foot Detail**

| Part No.<br>(ANSI 61 Gray) | Part No.<br>(RAL 7035 Light Gray) | Overall Dimensions |       |      | Door/Body Gauge | Latches Qty | Latches Type | Opt. Panel Part No. | Panel Size |       | # Hinges | F     | Ship Wt. (lbs) |
|----------------------------|-----------------------------------|--------------------|-------|------|-----------------|-------------|--------------|---------------------|------------|-------|----------|-------|----------------|
|                            |                                   | A                  | B     | C    |                 |             |              |                     | D          | E     |          |       |                |
| EN4SD12126GY               | EN4SD12126LG                      | 12.00              | 12.00 | 6.00 | 16              | 1           | Qtr Turn     | EP1212              | 10.20      | 10.20 | 2        | 6.00  | 12             |
| EN4SD12246GY               | EN4SD12246LG                      | 12.00              | 24.00 | 6.00 | 16              | 1           | Qtr Turn     | EP1224              | 10.20      | 22.20 | 2        | 18.00 | 24             |
| EN4SD16126GY               | EN4SD16126LG                      | 16.00              | 12.00 | 6.00 | 16              | 1           | Qtr Turn     | EP1612              | 14.20      | 10.20 | 2        | 10.00 | 16             |
| EN4SD16166GY               | EN4SD16166LG                      | 16.00              | 16.00 | 6.00 | 16              | 1           | Qtr Turn     | EP1616              | 14.20      | 14.20 | 2        | 10.00 | 19             |
| EN4SD16206GY               | EN4SD16206LG                      | 16.00              | 20.00 | 6.00 | 16              | 1           | Qtr Turn     | EP1620              | 14.20      | 18.20 | 2        | 10.00 | 22             |
| EN4SD20126GY               | EN4SD20126LG                      | 20.00              | 12.00 | 6.00 | 16              | 1           | Qtr Turn     | EP2012              | 18.20      | 10.20 | 2        | 14.00 | 20             |

| Part No.<br>(ANSI 61 Gray) | Part No.<br>(RAL 7035 Light Gray) | Overall<br>Dimensions |       |       | Door/Body<br>Gauge | Qty | Latches<br>Type   | Opt.<br>Panel<br>Part No. | Panel Size |       | #<br>Hinges | F     | Ship<br>Wt.<br>(lbs) |
|----------------------------|-----------------------------------|-----------------------|-------|-------|--------------------|-----|-------------------|---------------------------|------------|-------|-------------|-------|----------------------|
|                            |                                   | A                     | B     | C     |                    |     |                   |                           | D          | E     |             |       |                      |
| EN4SD202410GY              | EN4SD202410LG                     | 20.00                 | 24.00 | 10.00 | 16                 | 1   | Qtr. Turn         | EP2024                    | 18.20      | 22.20 | 2           | 14.00 | 36                   |
| EN4SD241210GY              | EN4SD241210LG                     | 24.00                 | 12.00 | 10.00 | 16                 | 1   | Qtr Turn          | EP2412                    | 22.20      | 10.20 | 2           | 18.00 | 26                   |
| EN4SD241610GY              | EN4SD241610LG                     | 24.00                 | 16.00 | 10.00 | 16                 | 1   | Qtr. Turn         | EP2416                    | 22.20      | 14.20 | 2           | 18.00 | 30                   |
| EN4SD242010GY              | EN4SD242010LG                     | 24.00                 | 20.00 | 10.00 | 16                 | 1   | Qtr. Turn         | EP2420                    | 22.20      | 18.20 | 2           | 18.00 | 36                   |
| EN4SD242410GY              | EN4SD242410LG                     | 24.00                 | 24.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP2424                    | 22.20      | 22.20 | 2           | 18.00 | 45                   |
| EN4SD243010GY              | EN4SD243010LG                     | 24.00                 | 30.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP2430                    | 22.20      | 28.20 | 2           | 18.00 | 53                   |
| EN4SD302010GY              | EN4SD302010LG                     | 30.00                 | 20.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP3020                    | 28.20      | 18.20 | 3           | 12.00 | 47                   |
| EN4SD302410GY              | EN4SD302410LG                     | 30.00                 | 24.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP3024                    | 28.20      | 22.20 | 3           | 12.00 | 53                   |
| EN4SD303010GY              | EN4SD303010LG                     | 30.00                 | 30.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP3030                    | 28.20      | 28.20 | 3           | 12.00 | 75                   |
| EN4SD362410GY              | EN4SD362410LG                     | 36.00                 | 24.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP3624                    | 34.20      | 22.20 | 3           | 15.00 | 70                   |
| EN4SD363010GY              | EN4SD363010LG                     | 36.00                 | 30.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP3630                    | 34.20      | 28.20 | 3           | 15.00 | 84                   |
| EN4SD363610GY              | EN4SD363610LG                     | 36.00                 | 36.00 | 10.00 | 14                 | 2   | Qtr. Turn         | EP3636                    | 34.20      | 34.20 | 3           | 15.00 | 100                  |
| EN4SD423010GY              | EN4SD423010LG                     | 42.00                 | 30.00 | 10.00 | 14                 | 1   | 3-point           | EP4230                    | 40.20      | 28.20 | 4           | 12.00 | 107                  |
| EN4SD423610GY              | EN4SD423610LG                     | 42.00                 | 36.00 | 10.00 | 14                 | 1   | 3-point           | EP4236                    | 40.20      | 34.20 | 4           | 12.00 | 117                  |
| EN4SD482410GY              | EN4SD482410LG                     | 48.00                 | 24.00 | 10.00 | 14                 | 1   | 3-point           | EP4824                    | 46.20      | 22.20 | 4           | 14.00 | 95                   |
| EN4SD483010GY              | EN4SD483010LG                     | 48.00                 | 30.00 | 10.00 | 14                 | 1   | 3-point           | EP4830                    | 46.20      | 28.20 | 4           | 14.00 | 120                  |
| EN4SD483610GY              | EN4SD483610LG                     | 48.00                 | 36.00 | 10.00 | 14                 | 1   | 3-point           | EP4836                    | 46.20      | 34.20 | 4           | 14.00 | 125                  |
| EN4SD603610GY              | EN4SD603610LG                     | 60.00                 | 36.00 | 10.00 | 14                 | 1   | 3-point           | EP6036                    | 58.20      | 34.20 | 4           | 18.00 | 150                  |
| EN4SD201612GY              | EN4SD201612LG                     | 20.00                 | 16.00 | 12.00 | 16                 | 1   | Qtr Turn          | EP2016                    | 18.20      | 14.20 | 2           | 14.00 | 32                   |
| EN4SD202012GY              | EN4SD202012LG                     | 20.00                 | 20.00 | 12.00 | 16                 | 1   | Qtr Turn          | EP2020                    | 18.20      | 18.20 | 2           | 14.00 | 34                   |
| EN4SD242012GY              | EN4SD242012LG                     | 24.00                 | 20.00 | 12.00 | 16                 | 1   | Qtr Turn          | EP2420                    | 22.20      | 18.20 | 2           | 18.00 | 38                   |
| EN4SD242412GY              | EN4SD242412LG                     | 24.00                 | 24.00 | 12.00 | 14                 | 2   | Qtr Turn          | EP2424                    | 22.20      | 22.20 | 2           | 18.00 | 47                   |
| EN4SD302412GY              | EN4SD302412LG                     | 30.00                 | 24.00 | 12.00 | 14                 | 2   | Qtr Turn          | EP3024                    | 28.20      | 22.20 | 3           | 12.00 | 57                   |
| EN4SD303012GY              | EN4SD303012LG                     | 30.00                 | 30.00 | 12.00 | 14                 | 2   | Qtr Turn          | EP3030                    | 28.20      | 28.20 | 3           | 12.00 | 80                   |
| EN4SD362412GY              | EN4SD362412LG                     | 36.00                 | 24.00 | 12.00 | 14                 | 2   | Qtr Turn          | EP3624                    | 34.20      | 22.20 | 3           | 15.00 | 62                   |
| EN4SD363012GY              | EN4SD363012LG                     | 36.00                 | 30.00 | 12.00 | 14                 | 2   | Qtr Turn          | EP3630                    | 34.20      | 28.20 | 3           | 15.00 | 91                   |
| EN4SD363612GY              | EN4SD363612LG                     | 36.00                 | 36.00 | 12.00 | 14                 | 2   | Qtr Turn          | EP3636                    | 34.20      | 34.20 | 3           | 15.00 | 104                  |
| EN4SD423012GY              | EN4SD423012LG                     | 42.00                 | 30.00 | 12.00 | 14                 | 1   | 3-point           | EP4230                    | 40.20      | 28.20 | 4           | 12.00 | 111                  |
| EN4SD423612GY              | EN4SD423612LG                     | 42.00                 | 36.00 | 12.00 | 14                 | 1   | 3-point           | EP4236                    | 40.20      | 34.20 | 4           | 12.00 | 121                  |
| EN4SD482412GY              | EN4SD482412LG                     | 48.00                 | 24.00 | 12.00 | 14                 | 1   | 3-point           | EP4824                    | 46.20      | 22.20 | 4           | 14.00 | 98                   |
| EN4SD483612GY              | EN4SD483612LG                     | 48.00                 | 36.00 | 12.00 | 14                 | 1   | 3-point           | EP4836                    | 46.20      | 34.20 | 4           | 14.00 | 148                  |
| EN4SD603612GY              | EN4SD603612LG                     | 60.00                 | 36.00 | 12.00 | 14                 | 1   | 3-point           | EP6036                    | 58.20      | 34.20 | 4           | 18.00 | 165                  |
| EN4SD723012GY              | EN4SD723012LG                     | 72.00                 | 30.00 | 12.00 | 14                 | 2   | Qtr Turn, 5-point | EP7230                    | 70.20      | 28.20 | 5           | 16.50 | 190                  |
| EN4SD723612GY              | EN4SD723612LG                     | 72.00                 | 36.00 | 12.00 | 14                 | 2   | Qtr Turn, 5-point | EP7236                    | 70.20      | 34.20 | 5           | 16.50 | 195                  |
| EN4SD242016GY              | EN4SD242016LG                     | 24.00                 | 20.00 | 16.00 | 16                 | 1   | Qtr Turn          | EP2420                    | 22.20      | 18.20 | 2           | 18.00 | 52                   |
| EN4SD242416GY              | EN4SD242416LG                     | 24.00                 | 24.00 | 16.00 | 14                 | 2   | Qtr Turn          | EP2424                    | 22.20      | 22.20 | 2           | 18.00 | 66                   |
| EN4SD302416GY              | EN4SD302416LG                     | 30.00                 | 24.00 | 16.00 | 14                 | 2   | Qtr Turn          | EP3024                    | 28.20      | 22.20 | 3           | 12.00 | 85                   |
| EN4SD363016GY              | EN4SD363016LG                     | 36.00                 | 30.00 | 16.00 | 14                 | 2   | Qtr Turn          | EP3630                    | 34.20      | 28.20 | 3           | 15.00 | 102                  |
| EN4SD423616GY              | EN4SD423616LG                     | 42.00                 | 36.00 | 16.00 | 14                 | 1   | 3-point           | EP4236                    | 40.20      | 34.20 | 4           | 12.00 | 140                  |

## Filter Fan Kits *DNFF Series*

### Features



- Kit includes one (1) of the following:
  - Fan
  - Plastic Filter Grill
  - Filter
  - Metal Grill
  - Wire Cord or Leads (see table)
  - Includes Mounting Hardware
- Flame retardant, ABS plastic filter fan grill is molded in a choice of four colors to match our racks & accessories.
  - "BK" (Black)
  - "GY" (ANSI 61 Gray)
  - "LG" (Light Gray - RAL7035)
  - "CG" (Beige)
- Fan is cooled by incoming air.
- Fan component is UL recognized to UL 507, and cUL recognized or CSA certified to CSA-C22.2 No. 113.

| Part No.<br>Black Filter Grill | Part No.<br>ANSI 61 Gray Filter Grill | Part No.<br>Gray/Beige Filter Grill | Part No.<br>Light Gray Filter Grill | VAC | Fan Size | CFM | Cord Length   |
|--------------------------------|---------------------------------------|-------------------------------------|-------------------------------------|-----|----------|-----|---------------|
| DNFF080BK115                   | DNFF080GY115                          | DNFF080CG115                        | DNFF080LG115                        | 115 | 3.15     | 32  | 11 Inch leads |
| DNFF120BK115                   | DNFF120GY115                          | DNFF120CG115                        | DNFF120LG115                        | 115 | 4.70     | 105 | 24 Inch cord  |
| DNFF150BK115                   | DNFF150GY115                          | DNFF150CG115                        | DNFF150LG115                        | 115 | 6.00     | 230 | 12 Inch leads |
| DNFF254BK115                   | DNFF254GY115                          | DNFF254CG115                        | DNFF254LG115                        | 115 | 10.00    | 550 | 24 Inch cord  |
| DNFF080BK230                   | DNFF080GY230                          | DNFF080CG230                        | DNFF080LG230                        | 230 | 3.15     | 32  | 11 Inch leads |
| DNFF120BK230                   | DNFF120GY230                          | DNFF120CG230                        | DNFF120LG230                        | 230 | 4.70     | 105 | 24 Inch cord  |
| DNFF150BK230                   | DNFF150GY230                          | DNFF150CG230                        | DNFF150LG230                        | 230 | 6.00     | 230 | 12 Inch leads |
| DNFF254BK230                   | DNFF254GY230                          | DNFF254CG230                        | DNFF254LG230                        | 230 | 10.00    | 550 | 24 Inch cord  |

*Data subject to change without notice*

## Thermostats *SKT Series*



### Features

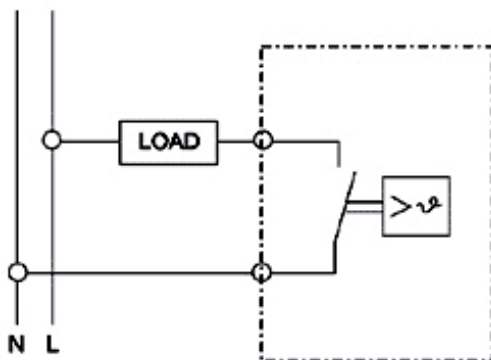
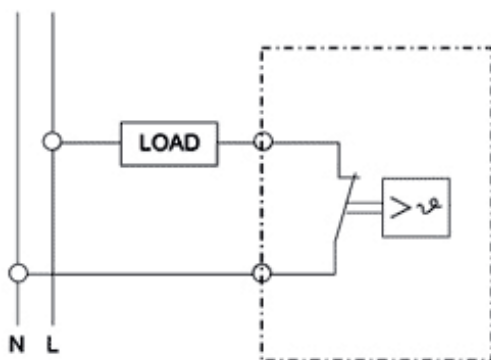
- Designed to provide air temperature control and monitoring in cabinets.
- Thermostat NC (Normally Closed) for the control of heaters and heater fans
- Thermostat NO (Normally Open) for the control of cooling units, or for switching signal transmitters in case of overheating.
- Available in Fahrenheit or Celsius.

### NC - Normally Closed (Red)

- Used in conjunction with heaters.
- Contact opens when rising temperatures reach the set point temperature, shutting heater off.

### NO - Normally open (Blue)

- Used in conjunction with fans.
- Contact closes when rising temperatures reach the set point temperature, turning fan on.



| Part No.    | Scale | Contact Type       | Dimensions                |  | Switching Capacity                      | Ship Wt.<br>lbs |
|-------------|-------|--------------------|---------------------------|--|-----------------------------------------|-----------------|
|             |       |                    | Height x Width x<br>Depth |  |                                         |                 |
| SKT011409NC | F°    | Normally<br>Closed | 2.8 x 1.5 x 1.4           |  | 15 A (1) AC 120 V, 10 A (1)<br>AC 250 V | 1               |

| Part No.             | Scale | Contact Type    | Dimensions                |  | Switching Capacity                   | Ship Wt.<br>lbs |
|----------------------|-------|-----------------|---------------------------|--|--------------------------------------|-----------------|
|                      |       |                 | Height x Width x<br>Depth |  |                                      |                 |
| <b>SKT011409NC-C</b> | C°    | Normally Closed | 2.8 x 1.5 x 1.4           |  | 15 A (1) AC 120 V, 10 A (1) AC 250 V | 1               |
| <b>SKT011419NO</b>   | F°    | Normally Open   | 2.8 x 1.5 x 1.4           |  | 15 A (1) AC 120 V, 10 A (1) AC 250 V | 1               |
| <b>SKT011419NO-C</b> | C°    | Normally Open   | 2.8 x 1.5 x 1.4           |  | 15 A (1) AC 120 V, 10 A (1) AC 250 V | 1               |

|                                    |                                                                     |
|------------------------------------|---------------------------------------------------------------------|
| Sensor Element:                    | Thermostatic bi-metal                                               |
| Switching difference (hysteresis): | + or - 4°F (+or- 3°K)                                               |
| Adjustment Range:                  | 30 - 140°F                                                          |
| Noise Suppression:                 | N (according to VDE 0875)                                           |
| Connection:                        | 2 pole terminal for AWG 14 (2.5 mm²)                                |
| Mounting:                          | Easily installed by clip mounting on 35 or 38mm DIN rail (included) |
| Housing:                           | Flame retardant plastic UL94VO                                      |
| Color:                             | Gray (SB)                                                           |
| Protection:                        | IP20                                                                |
| Approval:                          | UL Recognized Component, cUL Recognized Component, CE               |

*Data subject to change without notice*



# SMV

Frequency Inverter .....



Operating instructions EN



**Lenze**

**Copyright © 2013 - 2006 Lenze AC Tech Corporation**

All rights reserved. No part of this manual may be reproduced or transmitted in any form without written permission from Lenze AC Tech Corporation. The information and technical data in this manual are subject to change without notice. Lenze AC Tech Corporation makes no warranty of any kind with respect to this material, including, but not limited to, the implied warranties of its merchantability and fitness for a given purpose. Lenze AC Tech Corporation assumes no responsibility for any errors that may appear in this manual.

All information given in this documentation has been carefully selected and tested for compliance with the hardware and software described. Nevertheless, discrepancies cannot be ruled out. We do not accept any responsibility nor liability for damages that may occur. Any necessary corrections will be implemented in subsequent editions.

This document printed in the United States

# Contents

|                                                                 |           |
|-----------------------------------------------------------------|-----------|
| About these Instructions .....                                  | 2         |
| <b>1 Safety Information .....</b>                               | <b>3</b>  |
| <b>2 Technical Data .....</b>                                   | <b>7</b>  |
| 2.1 Standards and Application Conditions .....                  | 7         |
| 2.2 SMV Type Number Designation .....                           | 8         |
| 2.3 Ratings .....                                               | 9         |
| <b>3 Installation .....</b>                                     | <b>12</b> |
| 3.1 Dimensions and Mounting .....                               | 12        |
| 3.1.1 NEMA 1 (IP31) Models ≤ 30HP (22kW) .....                  | 12        |
| 3.1.2 NEMA 1 (IP31) Models > 30HP (22kW) .....                  | 13        |
| 3.1.3 NEMA 4X (IP65) Models .....                               | 14        |
| 3.1.4 NEMA 4X (IP65) Models with Disconnect Switch .....        | 15        |
| 3.2 Electrical Installation .....                               | 16        |
| 3.2.1 Power Connections .....                                   | 16        |
| 3.2.1.1 Mains Connection to 120VAC Single-Phase Supply .....    | 16        |
| 3.2.1.2 Mains Connection to 240VAC Single-Phase Supply .....    | 17        |
| 3.2.1.3 Mains Connection to Three-Phase Supply .....            | 17        |
| 3.2.1.4 Motor Connection .....                                  | 17        |
| 3.2.1.5 Installation Recommendations for EMC Compliance .....   | 18        |
| 3.2.1.6 NEMA 4X (IP65) Input Terminal Block .....               | 18        |
| 3.2.1.7 Dynamic Brake Connections .....                         | 19        |
| 3.2.2 Fuses/Cable Cross-Sections .....                          | 20        |
| 3.2.3 Control Terminals .....                                   | 21        |
| <b>4 Commissioning .....</b>                                    | <b>23</b> |
| 4.1 Local Keypad & Display .....                                | 23        |
| 4.2 Drive Display and Modes of Operation .....                  | 25        |
| 4.3 Parameter Setting .....                                     | 26        |
| 4.4 Electronic Programming Module (EPM) .....                   | 26        |
| 4.5 Parameter Menu .....                                        | 27        |
| 4.5.1 Basic Setup Parameters .....                              | 27        |
| 4.5.2 I/O Setup Parameters .....                                | 31        |
| 4.5.3 Advanced Setup Parameters .....                           | 35        |
| 4.5.4 PID Parameters .....                                      | 39        |
| 4.5.5 Vector Parameters .....                                   | 41        |
| 4.5.6 Network Parameters .....                                  | 43        |
| 4.5.7 Diagnostic Parameters .....                               | 44        |
| 4.5.7.1 Terminal & Protection Status Display .....              | 45        |
| 4.5.7.2 Keypad Status Display .....                             | 45        |
| 4.5.8 Onboard Communications Parameters 15-60HP (11-45kW) ..... | 46        |
| 4.5.9 Sequencer Parameters .....                                | 47        |
| 4.5.9.1 Sequencer Flow Diagram Left .....                       | 55        |
| 4.5.9.2 Sequencer Flow Diagram Right .....                      | 56        |
| 4.5.9.3 Sequencer Status .....                                  | 57        |
| <b>5 Troubleshooting and Diagnostics .....</b>                  | <b>58</b> |
| 5.1 Status/Warning Messages .....                               | 58        |
| 5.2 Drive Configuration Messages .....                          | 59        |
| 5.3 Fault Messages .....                                        | 59        |
| Appendix A .....                                                | 62        |
| A.1 Permissible Cable Lengths .....                             | 62        |

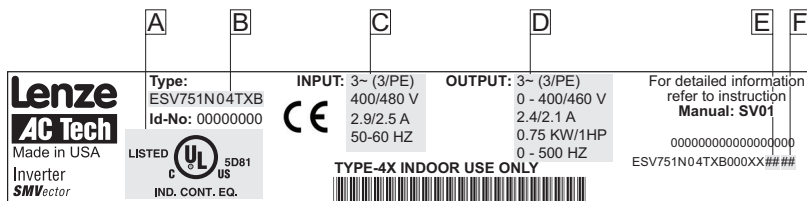


## About These Instructions

This documentation applies to the SMV frequency inverter and contains important technical data regarding the installation, operation, and commissioning of the inverter.

**These instructions are only valid for SMV frequency inverters with software revision 4.23 or higher** for version 4.23 software, the drive nameplate illustrated below would show “42” in the “F” location.

Please read these instructions in their entirety before commissioning the drive.



| A              | B    | C             | D              | E                | F                |
|----------------|------|---------------|----------------|------------------|------------------|
| Certifications | Type | Input Ratings | Output Ratings | Hardware Version | Software Version |

| Scope of delivery                                                                                                                              | Important                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>1 SMV Inverter with EPM installed (see Section 4.4)</li> <li>1 Operating Instructions manual</li> </ul> | <p>After receipt of the delivery, check immediately whether the items delivered match the accompanying papers. Lenze AC Tech does not accept any liability for deficiencies claimed subsequently.</p> <p>Claim:</p> <ul style="list-style-type: none"> <li>visible transport damage immediately to the forwarder.</li> <li>visible deficiencies /incompleteness immediately to your Lenze AC Tech representative</li> </ul> |

### Related Documents

The documentation listed herein contains information relevant to the operation of the SMVector frequency inverter. To obtain the latest documentation, visit the Technical Library at <http://www.lenzeamericas.com>.

| Document # | Description                                                          |
|------------|----------------------------------------------------------------------|
| CMVINS01   | SMVector Communications Module Installation Instruction              |
| CMVMB401   | SMVector ModBus RTU over RS485 Communications Reference Guide        |
| CMVLC401   | SMVector Locom Communications Reference Guide                        |
| CMVCAN01   | SMVector CANopen Communications Reference Guide                      |
| CMVDVN01   | SMVector DeviceNet Communications Reference Guide                    |
| CMVETH01   | SMVector EtherNet/IP Communications Reference Guide                  |
| CMVPFB01   | SMVector PROFIBUS Communications Reference Guide                     |
| ALSV01     | SMVector Additional I/O Module Installation and Operation Manual     |
| DBV01      | SMVector Dynamic Braking                                             |
| PTV01      | SMVector Potentiometer Install Instructions                          |
| RKV01      | SMVector ESZVK1 Remote Keypad                                        |
| RKVU01     | SMVector ESZVXH0 Remote Keypad (for NEMA 1 15-60HP (11-45kW) Drives) |



## 1 Safety Information

### General

Some parts of Lenze AC Tech controllers can be electrically live and some surfaces can be hot. Non-authorized removal of the required cover, inappropriate use, and incorrect installation or operation creates the risk of severe injury to personnel and/or damage to equipment.

All operations concerning transport, installation, and commissioning as well as maintenance must be carried out by qualified, skilled personnel who are familiar with the installation, assembly, commissioning, and operation of variable frequency drives and the application for which it is being used.

### Installation

Ensure proper handling and avoid excessive mechanical stress. Do not bend any components and do not change any insulation distances during transport, handling, installation or maintenance. Do not touch any electronic components or contacts. This drive contains electrostatically sensitive components, which can easily be damaged by inappropriate handling. Static control precautions must be adhered to during installation, testing, servicing and repairing of this drive and associated options. Component damage may result if proper procedures are not followed.

To ensure proper operation, do not install the drive where it is subjected to adverse environmental conditions such as combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

This drive has been tested by Underwriters Laboratory (UL) and is UL Listed in compliance with the UL508C Safety Standard. This drive must be installed and configured in accordance with both national and international standards. Local codes and regulations take precedence over recommendations provided in this and other Lenze AC Tech documentation.

The SMVector drive is considered a component for integration into a machine or process. It is neither a machine nor a device ready for use in accordance with European directives (reference machinery directive and electromagnetic compatibility directive). It is the responsibility of the end user to ensure that the machine meets the applicable standards.

### Electrical Connection

When working on live drive controllers, applicable national safety regulations must be observed. The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, protective earth [PE] connection). While this document does make recommendations in regards to these items, national and local codes must be adhered to.

The documentation contains information about installation in compliance with EMC (shielding, grounding, filters and cables). These notes must also be observed for CE-marked controllers. The manufacturer of the system or machine is responsible for compliance with the required limit values demanded by EMC legislation.

### Application

The drive must not be used as a safety device for machines where there is a risk of personal injury or material damage. Emergency Stops, over-speed protection, acceleration and deceleration limits, etc must be made by other devices to ensure operation under all conditions.

The drive does feature many protection devices that work to protect the drive and the driven equipment by generating a fault and shutting the drive and motor down. Mains power variances can also result in shutdown of the drive. When the fault condition disappears or is cleared, the drive can be configured to automatically restart, it is the responsibility of the user, OEM and/or integrator to ensure that the drive is configured for safe operation.



## Safety Information

### Explosion Proof Applications

Explosion proof motors that are not rated for inverter use lose their certification when used for variable speed. Due to the many areas of liability that may be encountered when dealing with these applications, the following statement of policy applies:

Lenze AC Tech Corporation inverter products are sold with no warranty of fitness for a particular purpose or warranty of suitability for use with explosion proof motors. Lenze AC Tech Corporation accepts no responsibility for any direct, incidental or consequential loss, cost or damage that may arise through the use of AC inverter products in these applications. The purchaser expressly agrees to assume all risk of any loss, cost or damage that may arise from such application.

### Operation

Systems including controllers must be equipped with additional monitoring and protection devices according to the corresponding standards (e.g. technical equipment, regulations for prevention of accidents, etc.). The controller may be adapted to your application as described in this documentation.



#### DANGER!

- After the controller has been disconnected from the supply voltage, live components and power connection must not be touched immediately, since capacitors could be charged. Please observe the corresponding notes on the controller.
- Close all protective covers and doors prior to and during operation.
- Do not cycle input power to the controller more than once every two minutes.
- For SMVector models that are equipped with a Disconnect Switch (11th character in model number is L or M), the Disconnect Switch is intended as a motor service disconnect and does not provide branch circuit protection to the inverter or motor. When servicing the motor, it is necessary to wait 3 minutes after turning this switch to the off position before working on motor power wiring as the inverter stores electrical power. To service the inverter, it is necessary to remove mains ahead of the drive and wait 3 minutes.

### Safety Notifications

All safety information given in these Operating Instructions includes a visual icon, a bold signal word and a description.



**Signal Word!** (characterizes the severity of the danger)

**NOTE** (describes the danger and informs on how to proceed)

| Icon | Signal Word                     | Meaning                                                                                                                                          | Consequences if ignored                                                   |
|------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|      | <b>DANGER!</b>                  | Warns of hazardous electrical voltage.                                                                                                           | Death or severe injuries.                                                 |
|      | <b>WARNING!</b>                 | Warns of potential, very hazardous situations.                                                                                                   | Risk of severe injury to personnel and/or damage to equipment.            |
|      | <b>WARNING!<br/>Hot Surface</b> | Warns of hot surface and risk of burns. Labels may be on or inside the equipment to alert people that surfaces may reach dangerous temperatures. | Risk of severe injury to personnel.                                       |
|      | <b>STOP!</b>                    | Warns of potential damage to material and equipment.                                                                                             | Damage to the controller/drive or its environment.                        |
|      | <b>NOTE</b>                     | Designates a general, useful note.                                                                                                               | None. If observed, then using the controller/drive system is made easier. |



## Harmonics Notification in accordance with EN 61000-3-2, EN 61000-3-12:

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

| Directive     | Total Power connected to Mains (public supply) | Additional Measures Required for Compliance <sup>(2)</sup>        |
|---------------|------------------------------------------------|-------------------------------------------------------------------|
| EN 61000-3-2  | < 0.5kW                                        | with mains choke                                                  |
|               | 0.5 ... 1kW                                    | with active filter                                                |
|               | > 1kW                                          | complies without additional measures                              |
| EN 61000-3-12 | 16 ... 75amp                                   | Additional measures are required for compliance with the standard |

(1) For compliance with EMC regulations, the permissible cable lengths may change.

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.

## Safety Information in accordance with EN 61800-5-1:



### **DANGER! - Risk of Electric Shock**

Capacitors retain charge for approximately 180 seconds after power is removed. Disconnect incoming power and wait at least 3 minutes before touching the drive.

### **DANGER! - Risque de choc électrique**

Les condensateurs restent sous charge pendant environ 180 secondes après une coupure de courant. Couper l'alimentation et patienter pendant au moins 3 minutes avant de toucher l'entraînement.



### **WARNING!**

- This product can cause a d.c. current in the PE conductor. Where a residual current-operated (RCD) or monitoring (RCM) device is used for protection in case of direct or indirect contact, only an RCD or RCM Type B is allowed on the supply side of this product.
- Leakage Current may exceed 3.5mA AC. The minimum size of the PE conductor shall comply with local safety regulations for high leakage current equipment.
- In a domestic environment, this product may cause radio interference in which case supplementary mitigation measures may be required.



## Safety Information

### Safety Information in accordance with UL:

Note for UL approved system with integrated controllers: UL warnings are notes which apply to UL systems.  
The documentation contains special information about UL.



- Integral solid state protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes. The use of fuses or circuit breakers is the only approved means for branch circuit protection.
- When protected by CC and T Class Fuses, suitable for use on a circuit capable of delivering not more than 200,000 rms symmetrical amperes, at the maximum voltage rating marked on the drive.
- Additionally suitable when protected by a circuit breaker having an interrupting rating not less than 200,000 rms symmetrical amperes, at the maximum voltage rating marked on the drive. (Excludes ESV113xx2T, ESV153xx2T, ESV113xx4T, ESV153xx4T, ESV183xx4T, ESV223xx4T, ESV303xx4T, ESV113xx6T, ESV153xx6T, ESV183xx6T, ESV223xx6T, and ESV303xx6T).
- Use minimum 75°C copper wire only, except for control circuits.
- For control circuits, use wiring suitable for NEC Class 1 circuits only.
- Torque Requirements (in accordance with UL) are listed in section 3.2.1, Power Connections and in 3.2.3, Control terminals
- Shall be installed in a pollution degree 2 macro-environment.
- NEMA 1 (IP31) models shall be installed in a pollution degree 2 macro-environment.
- All models are suitable for installation in a compartment handling Conditioned Air (i.e., plenum rated).



#### WARNING!

The opening of branch-circuit protective device may be an indication that a fault has been interrupted. To reduce the risk of fire or electric shock, current carrying parts and other components of the controller should be examined and replaced if damaged.



#### AVERTISSEMENT!

Le déclenchement du dispositif de protection du circuit de dérivation peut être dû à une coupure qui résulte d'un courant de défaut. Pour limiter le risque d'incendie ou de choc électrique, examiner les pièces porteuses de courant et les autres éléments du contrôleur et les remplacer s'ils sont endommagés. En cas de grillage de l'élément traverse par le courant dans un relais de surcharge, le relais tout entier doit être remplacé.



#### NOTE

Control and communications terminals provide reinforced insulation (i.e. considered SELV or PELV, providing protection in case of direct contact) when the drive is connected to a power system rated up to 300VAC between phase to ground (PE) and the applied voltage on Terminals 16 and 17 is less than 150VAC between phase to ground. Otherwise, control and communications terminals provide basic insulation.





## 2 Technical Data

### 2.1 Standards and Application Conditions

|                                                                                                                |                                                                                                                                                                  |                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Conformity</b>                                                                                              | CE                                                                                                                                                               | Low Voltage (2006/95/EC) & EMC (2004/108/EC) Directives                                                                                                                                                                                                         |
| <b>Approvals</b>                                                                                               | UL508C                                                                                                                                                           | Underwriters Laboratories -Power Conversion Equipment                                                                                                                                                                                                           |
| <b>Input voltage phase imbalance</b>                                                                           | ≤ 2%                                                                                                                                                             |                                                                                                                                                                                                                                                                 |
| <b>Supported Power Systems</b>                                                                                 | TT<br>TN                                                                                                                                                         | <ul style="list-style-type: none"> <li>For central grounded systems, operation is permitted without restrictions.</li> <li>For corner grounded 400/500V systems, operation is possible but reinforced insulation to control circuits is compromised.</li> </ul> |
| <b>Humidity</b>                                                                                                | ≤ 95% non-condensing                                                                                                                                             |                                                                                                                                                                                                                                                                 |
| <b>Temperature range</b>                                                                                       | Transport                                                                                                                                                        | -25 ... +70°C                                                                                                                                                                                                                                                   |
|                                                                                                                | Storage                                                                                                                                                          | -20 ... +70°C                                                                                                                                                                                                                                                   |
|                                                                                                                | Operation                                                                                                                                                        | -10 ... +55°C (with 2.5%/°C current derating above +40°C)                                                                                                                                                                                                       |
| <b>Installation height</b>                                                                                     | 0 - 4000m a.m.s.l.                                                                                                                                               | (with 5%/1000 m current derating above 1000m a.m.s.l.)                                                                                                                                                                                                          |
| <b>Vibration resistance</b>                                                                                    | acceleration resistant up to 1.0g                                                                                                                                |                                                                                                                                                                                                                                                                 |
|  <b>Earth leakage current</b> | > 3.5 mA to PE                                                                                                                                                   |                                                                                                                                                                                                                                                                 |
| <b>Max Permissible Cable Length <sup>(1)</sup></b>                                                             | ≤ 4.0 Hp (3.0 kW)                                                                                                                                                | 30 meters shielded, 60 meters un-shielded                                                                                                                                                                                                                       |
|                                                                                                                | > 5.0 Hp (3.7 kW)                                                                                                                                                | 50 meters shielded, 100 meters un-shielded.                                                                                                                                                                                                                     |
| <b>Enclosure</b>                                                                                               | IP31/NEMA 1                                                                                                                                                      | IP65/NEMA 4X                                                                                                                                                                                                                                                    |
|                                                                                                                | NEMA 1 and NEMA 4X model enclosures are plenum rated in accordance with UL 508C and are suitable for installation in a compartment handling conditioned air.     |                                                                                                                                                                                                                                                                 |
| <b>Protection measures against</b>                                                                             | Earth fault, phase loss, over voltage, under voltage, motor stalling, over temperature motor overload (125% of FLA), short circuit (SCCR=200kA at rated voltage) |                                                                                                                                                                                                                                                                 |
| <b>Compliance with EN 61000-3-2 Requirements <sup>(2)</sup></b>                                                | < 0.5kW                                                                                                                                                          | with mains choke                                                                                                                                                                                                                                                |
|                                                                                                                | 0.5 ... 1kW                                                                                                                                                      | with active filter                                                                                                                                                                                                                                              |
|                                                                                                                | > 1kW                                                                                                                                                            | without additional measures                                                                                                                                                                                                                                     |
| <b>Compliance with EN 61000-3-12 Requirements <sup>(2)</sup></b>                                               | 16 ... 75amp                                                                                                                                                     | Additional measures required for compliance with EN 61000-3-12                                                                                                                                                                                                  |

Operation in public supply networks (Limitation of harmonic currents i.a.w. EN 61000-3-2, Electromagnetic Compatibility (EMC) Limits). Limits for harmonic current emissions (equipment input current up to 16A/phase).

(1) The stated cable lengths are permissible at default carrier frequencies (refer to parameter P166).

(2) The additional measures described only ensure that the controller meets the requirements of the EN 61000-3-2. The machine/system manufacturer is responsible for the machine's compliance with the regulations.



## Technical Data

### 2.2 SMV Type Number Designation

The table herein describes the Type numbering designation for the SMVector Inverter models.

| Electrical Products in the SMVector Series                                                                                                                                                                                                                                                                       |  | NO                                           | 2 | T | X | B |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------|---|---|---|---|
| <b>Power Rating in kW:</b><br>251 = 0.25kW (0.33HP)<br>371 = 0.37kW (0.5HP)<br>751 = 0.75kW (1HP)<br>112 = 1.1kW (1.5HP)<br>152 = 1.5kW (2HP)<br>222 = 2.2kW (3HP)<br>302 = 3.0kW (4HP)<br>402 = 4.0kW (5HP)<br>552 = 5.5kW (7.5HP)<br>752 = 7.5kW (10HP)                                                        |  | 152                                          |   |   |   |   |
| <b>Installed I/O &amp; Communication Module(s):</b><br>C_ = CANopen (Available all models)<br>D_ = DeviceNet (Available all models)<br>E_ = Ethernet/IP, (Available all models)<br>R_ = RS-485 / ModBus /Lecom (Avail all models)<br>P_ = Profibus-DP (Available all models)<br>N_ = No Communications installed |  | The " " blank can be:<br>0 = Standard Keypad |   |   |   |   |
| <b>Input Voltage:</b><br>1 = 120 VAC (doubler output) or 240 VAC<br>2 = 240 VAC<br>4 = 400/480 VAC<br>6 = 600 VAC                                                                                                                                                                                                |  |                                              |   |   |   |   |
| <b>Input Phase:</b><br>S = Single Phase Input only<br>Y = Single or Three Phase Input<br>T = Three Phase Input only                                                                                                                                                                                              |  |                                              |   |   |   |   |
| <b>Input Line Filter</b><br>F = Integral EMC Filter<br>L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)<br>M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)<br>X = No EMC Filter/ No Disconnect Switch                                                             |  |                                              |   |   |   |   |
| <b>Enclosure:</b><br>B = NEMA 1/IP31; Indoor only<br>C = NEMA 4X/IP65; Indoor only; Convection cooled<br>D = NEMA 4X/IP65; Indoor only; Fan cooled<br>E = NEMA 4X/IP65; Indoor/Outdoor; Convection cooled<br>F = NEMA 4X/IP65; Indoor/Outdoor; Fan cooled                                                        |  |                                              |   |   |   |   |



#### NOTE

**Prior to installation make sure the enclosure is suitable for the end-use environment**

Variables that influence enclosure suitability include (but are not limited to) temperature, airborne contaminants, chemical concentration, mechanical stress and duration of exposure (sunlight, wind, precipitation).



## 2.3 Ratings

### 120V / 240VAC Models

| Mains = 120V Single Phase (1/N/PE) (90...132V), 240V Single Phase (2/PE) (170...264V); 48...62Hz |       |      |               |           |                             |            |                   |                       |                       |
|--------------------------------------------------------------------------------------------------|-------|------|---------------|-----------|-----------------------------|------------|-------------------|-----------------------|-----------------------|
| Type                                                                                             | Power |      | Mains Current |           | Output Current              |            | Heat Loss (Watts) |                       |                       |
|                                                                                                  | Hp    | kW   | 120V<br>A     | 240V<br>A | Cont (I <sub>n</sub> )<br>A | Max I<br>% | N1/IP31           | N4X/IP65<br>No filter | N4X/IP65<br>W/ filter |
| ESV251--1S--                                                                                     | 0.33  | 0.25 | 6.8           | 3.4       | 1.7                         | 200        | 24                |                       |                       |
| ESV371--1S--                                                                                     | 0.5   | 0.37 | 9.2           | 4.6       | 2.4                         | 200        | 32                | 32                    |                       |
| ESV751--1S--                                                                                     | 1     | 0.75 | 16.6          | 8.3       | 4.2                         | 200        | 52                | 41                    |                       |
| ESV112--1S--                                                                                     | 1.5   | 1.1  | 20            | 10.0      | 6.0                         | 200        | 74                | 74                    |                       |

#### NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (I<sub>n</sub>) rating and is adjustable in parameter P171.

### 240VAC Models

| Mains = 240V Single Phase (2/PE) (170...264V); 48...62Hz |       |      |               |  |                             |            |                   |                       |                       |
|----------------------------------------------------------|-------|------|---------------|--|-----------------------------|------------|-------------------|-----------------------|-----------------------|
| Type                                                     | Power |      | Mains Current |  | Output Current              |            | Heat Loss (Watts) |                       |                       |
|                                                          | Hp    | kW   | 240V<br>A     |  | Cont (I <sub>n</sub> )<br>A | Max I<br>% | N1/IP31           | N4X/IP65<br>No filter | N4X/IP65<br>W/ filter |
| ESV251--2S--                                             | 0.33  | 0.25 | 3.4           |  | 1.7                         | 200        | 20                |                       |                       |
| ESV371--2S--                                             | 0.5   | 0.37 | 5.1           |  | 2.4                         | 200        |                   |                       | 30                    |
| ESV751--2S--                                             | 1     | 0.75 | 8.8           |  | 4.2                         | 200        |                   |                       | 42                    |
| ESV112--2S--                                             | 1.5   | 1.1  | 12.0          |  | 6.0                         | 200        |                   |                       | 63                    |
| ESV152--2S--                                             | 2     | 1.5  | 13.3          |  | 7.0                         | 200        |                   |                       | 73                    |
| ESV222--2S--                                             | 3     | 2.2  | 17.1          |  | 9.6                         | 200        |                   |                       | 97                    |

| 240V Single Phase (2/PE) (170...264V), 240V Three Phase (3/PE) (170...264V); 48...62Hz |       |      |                |                |                             |            |                   |                       |                       |
|----------------------------------------------------------------------------------------|-------|------|----------------|----------------|-----------------------------|------------|-------------------|-----------------------|-----------------------|
| Type                                                                                   | Power |      | Mains Current  |                | Output Current              |            | Heat Loss (Watts) |                       |                       |
|                                                                                        | Hp    | kW   | 1~ (2/PE)<br>A | 3~ (3/PE)<br>A | Cont (I <sub>n</sub> )<br>A | Max I<br>% | N1/IP31           | N4X/IP65<br>No filter | N4X/IP65<br>W/ filter |
| ESV371--2Y--                                                                           | 0.5   | 0.37 | 5.1            | 2.9            | 2.4                         | 200        | 27                | 26                    |                       |
| ESV751--2Y--                                                                           | 1     | 0.75 | 8.8            | 5.0            | 4.2                         | 200        | 41                | 38                    |                       |
| ESV112--2Y--                                                                           | 1.5   | 1.1  | 12.0           | 6.9            | 6.0                         | 200        | 64                | 59                    |                       |
| ESV152--2Y--                                                                           | 2     | 1.5  | 13.3           | 8.1            | 7.0                         | 200        | 75                | 69                    |                       |
| ESV222--2Y--                                                                           | 3     | 2.2  | 17.1           | 10.8           | 9.6                         | 200        | 103               | 93                    |                       |

| 240V Three Phase (3/PE) (170...264V); 48...62Hz |       |    |               |  |                             |            |                   |                       |                       |
|-------------------------------------------------|-------|----|---------------|--|-----------------------------|------------|-------------------|-----------------------|-----------------------|
| Type                                            | Power |    | Mains Current |  | Output Current              |            | Heat Loss (Watts) |                       |                       |
|                                                 | Hp    | kW | 240V<br>A     |  | Cont (I <sub>n</sub> )<br>A | Max I<br>% | N1/IP31           | N4X/IP65<br>No filter | N4X/IP65<br>W/ filter |



## Technical Data

|              |     |     |      |      |     |     |     |  |
|--------------|-----|-----|------|------|-----|-----|-----|--|
| ESV112--2T-- | 1.5 | 1.1 | 6.9  | 6    | 200 | 64  |     |  |
| ESV152--2T-- | 2   | 1.5 | 8.1  | 7    | 200 | 75  |     |  |
| ESV222--2T-- | 3   | 2.2 | 10.8 | 9.6  | 200 | 103 |     |  |
| ESV402--2T-- | 5   | 4.0 | 18.6 | 16.5 | 200 | 154 | 139 |  |
| ESV552--2T-- | 7.5 | 5.5 | 26   | 23   | 200 | 225 | 167 |  |
| ESV752--2T-- | 10  | 7.5 | 33   | 29   | 200 | 274 | 242 |  |
| ESV113--2T-- | 15  | 11  | 48   | 42   | 180 | 485 | 468 |  |
| ESV153--2T-- | 20  | 15  | 59   | 54   | 180 | 614 | 591 |  |

### NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

## 400...480VAC Models

| 400 ... 480V Three Phase (3/PE) (400V: 340...440V), (480V: 340...528V); 48...62Hz |       |      |               |           |                             |      |            |      |                   |                       |                       |
|-----------------------------------------------------------------------------------|-------|------|---------------|-----------|-----------------------------|------|------------|------|-------------------|-----------------------|-----------------------|
| Type                                                                              | Power |      | Mains Current |           | Output Current              |      |            |      | Heat Loss (Watts) |                       |                       |
|                                                                                   | Hp    | kW   | 400V<br>A     | 480V<br>A | Cont (I <sub>n</sub> )<br>A |      | Max I<br>% |      | N1/IP31           | N4X/IP65<br>No filter | N4X/IP65<br>W/ filter |
|                                                                                   |       |      |               |           | 400V                        | 480V | 400V       | 480V |                   |                       |                       |
| ESV371--4T--                                                                      | 0.5   | 0.37 | 1.7           | 1.5       | 1.3                         | 1.1  | 175        | 200  | 23                | 21                    | 25                    |
| ESV751--4T--                                                                      | 1     | 0.75 | 2.9           | 2.5       | 2.4                         | 2.1  | 175        | 200  | 37                | 33                    | 37                    |
| ESV112--4T--                                                                      | 1.5   | 1.1  | 4.2           | 3.6       | 3.5                         | 3.0  | 175        | 200  | 48                | 42                    | 46                    |
| ESV152--4T--                                                                      | 2     | 1.5  | 4.7           | 4.1       | 4.0                         | 3.5  | 175        | 200  | 57                | 50                    | 54                    |
| ESV222--4T--                                                                      | 3     | 2.2  | 6.1           | 5.4       | 5.5                         | 4.8  | 175        | 200  | 87                | 78                    | 82                    |
| ESV302--4T--                                                                      | 4     | 3.0  | 8.3           | 7.0       | 7.6                         | 6.3  | 175        | 200  |                   |                       | 95                    |
| ESV402--4T--                                                                      | 5     | 4.0  | 10.6          | 9.3       | 9.4                         | 8.2  | 175        | 200  | 128               | 103                   | 111                   |
| ESV552--4T--                                                                      | 7.5   | 5.5  | 14.2          | 12.4      | 12.6                        | 11.0 | 175        | 200  | 178               | 157                   | 165                   |
| ESV752--4T--                                                                      | 10    | 7.5  | 18.1          | 15.8      | 16.1                        | 14.0 | 175        | 200  | 208               | 190                   | 198                   |
| ESV113--4T--                                                                      | 15    | 11   | 27            | 24        | 24                          | 21   | 155        | 180  | 418               | 388                   | 398                   |
| ESV153--4T--                                                                      | 20    | 15   | 35            | 31        | 31                          | 27   | 155        | 180  | 493               | 449                   | 459                   |
| ESV183--4T--                                                                      | 25    | 18.5 | 44            | 38        | 39                          | 34   | 155        | 180  | 645               | 589                   | 600                   |
| ESV223--4T--                                                                      | 30    | 22   | 52            | 45        | 46                          | 40   | 155        | 180  | 709               | 637                   | 647                   |
| ESV303--4T--                                                                      | 40    | 30   | 68            | 59        | 60                          | 52   | 155        | 180  | 1020              |                       |                       |
| ESV373--4T--                                                                      | 50    | 37.5 | 85            | 74        | 75                          | 65   | 155        | 180  | 1275              |                       |                       |
| ESV453--4T--                                                                      | 60    | 45   | 100           | 87        | 88                          | 77   | 155        | 180  | 1530              |                       |                       |

### NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (In) rating and is adjustable in parameter P171.

For 400...480 VAC models, the output current maximum (%) in the 400V column is used when P107 = 0

For 400...480 VAC models, the output current maximum (%) in the 480V column is used when P107 = 1



## 600VAC Models

| 600V Three Phase (3/PE) (425...660V); 48...62Hz |       |      |               |                             |            |                   |                       |                       |
|-------------------------------------------------|-------|------|---------------|-----------------------------|------------|-------------------|-----------------------|-----------------------|
| Type                                            | Power |      | Mains Current | Output Current              |            | Heat Loss (Watts) |                       |                       |
|                                                 | Hp    | kW   | A             | Cont (I <sub>n</sub> )<br>A | Max I<br>% | N1/IP31           | N4X/IP65<br>No filter | N4X/IP65<br>W/ filter |
| ESV751--6T--                                    | 1     | 0.75 | 2             | 1.7                         | 200        | 37                | 31                    |                       |
| ESV152--6T--                                    | 2     | 1.5  | 3.2           | 2.7                         | 200        | 51                | 43                    |                       |
| ESV222--6T--                                    | 3     | 2.2  | 4.4           | 3.9                         | 200        | 68                | 57                    |                       |
| ESV402--6T--                                    | 5     | 4    | 6.8           | 6.1                         | 200        | 101               | 67                    |                       |
| ESV552--6T--                                    | 7.5   | 5.5  | 10.2          | 9                           | 200        | 148               | 116                   |                       |
| ESV752--6T--                                    | 10    | 7.5  | 12.4          | 11                          | 200        | 172               | 152                   |                       |
| ESV113--6T--                                    | 15    | 11   | 19.7          | 17                          | 180        | 380               | 356                   |                       |
| ESV153--6T--                                    | 20    | 15   | 25            | 22                          | 180        | 463               | 431                   |                       |
| ESV183--6T--                                    | 25    | 18.5 | 31            | 27                          | 180        | 560               | 519                   |                       |
| ESV223--6T--                                    | 30    | 22   | 36            | 32                          | 180        | 640               | 592                   |                       |
| ESV303--6T--                                    | 40    | 30   | 47            | 41                          | 180        | 930               |                       |                       |
| ESV373--6T--                                    | 50    | 37.5 | 59            | 52                          | 180        | 1163              |                       |                       |
| ESV453--6T--                                    | 60    | 45   | 71            | 62                          | 180        | 1395              |                       |                       |

### NOTES:

Output Current: The Output Current Maximum (%) is a percentage of the Output Current Continuous Amps (I<sub>n</sub>) rating and is adjustable in parameter P171.



### STOP!

- For installations above 1000m a.m.s.l., derate I<sub>n</sub> by 5% per 1000m, do not exceed 4000m a.m.s.l.
- Operation above 40°C, derate I<sub>n</sub> by 2.5% per °C, do not exceed 55°C.

Output Current (I<sub>n</sub>) derating for Carrier Frequency (P166) for NEMA 1 (IP31) Models:

- If P166=2 (8 kHz), derate I<sub>n</sub> to 92% of drive rating
- If P166=3 (10 kHz), derate I<sub>n</sub> to 84% of drive rating

Output Current (I<sub>n</sub>) derating for Carrier Frequency (P166) for NEMA 4X (IP65) Models:

- If P166=1 (6 kHz), derate I<sub>n</sub> to 92% of drive rating
- If P166=2 (8 kHz), derate I<sub>n</sub> to 84% of drive rating
- If P166=3 (10 kHz), derate I<sub>n</sub> to 76% of drive rating



# Installation

## 3 Installation

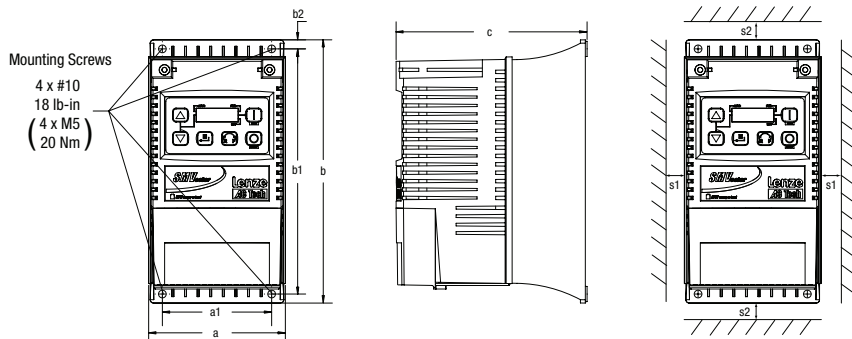
### 3.1 Dimensions and Mounting



#### WARNING!

Drives must not be installed where subjected to adverse environmental conditions such as: combustible, oily, or hazardous vapors; corrosive chemicals; excessive dust, moisture or vibration; direct sunlight or extreme temperatures.

#### 3.1.1 NEMA 1 (IP31) Models ≤ 30HP (22kW)

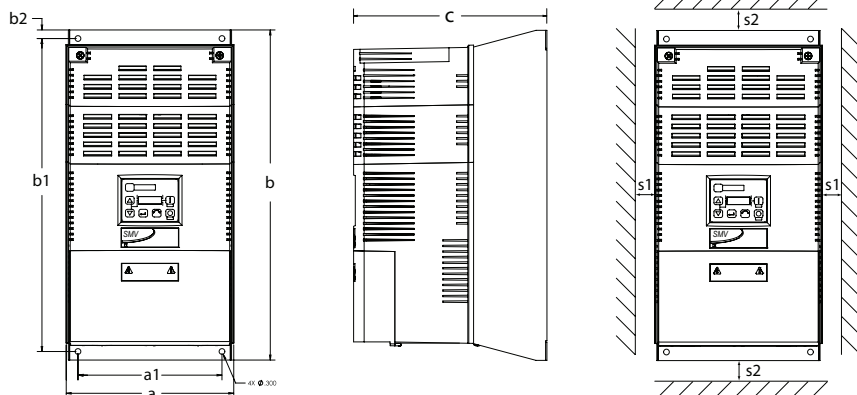


|    | Type                                                     | a<br>in (mm) | a1<br>in (mm) | b<br>in (mm) | b1<br>in (mm) | b2<br>in (mm) | c<br>in (mm) | s1<br>in (mm) | s2<br>in (mm) | m<br>lb (kg) |
|----|----------------------------------------------------------|--------------|---------------|--------------|---------------|---------------|--------------|---------------|---------------|--------------|
| G1 | ESV251-----B; ESV371<br>ESV751-----B                     | 3.90 (99)    | 3.12 (79)     | 7.48 (190)   | 7.00 (178)    | 0.24 (6)      | 4.35 (111)   | 0.6 (15)      | 2.0 (50)      | 2.0 (0.9)    |
| G2 | ESV112-----B; ESV152-----B<br>ESV222-----B               | 3.90 (99)    | 3.12 (79)     | 7.52 (191)   | 7.00 (178)    | 0.26 (7)      | 5.45 (138)   | 0.6 (15)      | 2.0 (50)      | 2.8 (1.3)    |
| G3 | ESV402-----B                                             | 3.90 (99)    | 3.12 (79)     | 7.52 (191)   | 7.00 (178)    | 0.30 (8)      | 5.80 (147)   | 0.6 (15)      | 2.0 (50)      | 3.2 (1.5)    |
| H1 | ESV552-----B; ESV752-----B                               | 5.12 (130)   | 4.25 (108)    | 9.83 (250)   | 9.30 (236)    | 0.26 (7)      | 6.30 (160)   | 0.6 (15)      | 2.0 (50)      | 6.0 (2.0)    |
| J1 | ESV113-----B; ESV153-----B<br>ESV183-----B; ESV223-----B | 6.92 (176)   | 5.75 (146)    | 12.50 (318)  | 11.88 (302)   | 0.31 (8)      | 8.09 (205)   | 0.6 (15)      | 2.0 (50)      | 13.55 (6.15) |

| Conduit Hole Dimensions | Type | N<br>in (mm) | P<br>in (mm) | P1<br>in (mm) | Q<br>in (mm) | S<br>in (mm)          |
|-------------------------|------|--------------|--------------|---------------|--------------|-----------------------|
|                         | G1   | 1.84 (47)    | 1.93 (49)    | .70 (18)      | 1.00 (25)    | .88 (22)              |
|                         | G2   | 1.84 (47)    | 3.03 (77)    | .70 (18)      | 1.00 (25)    | .88 (22)              |
|                         | G3   | 1.84 (47)    | 3.38 (86)    | .70 (18)      | 1.00 (25)    | .88 (22)              |
|                         | H1   | 2.46 (62)    | 3.55 (90)    | .13 (3)       | 1.38 (35)    | 1.13 (29)<br>.88 (22) |
|                         | J1   | 3.32 (84)    | 4.62 (117)   | .73 (19)      | 1.40 (36)    | 1.31 (33)<br>.88 (22) |



## 3.1.2 NEMA 1 (IP31) Models > 30HP (22kW)



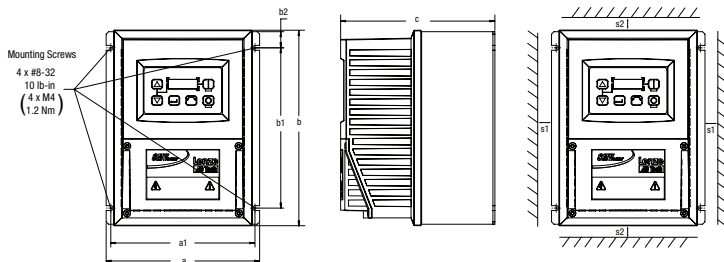
|    | Type                      | a<br>in (mm) | a1<br>in (mm) | b<br>in (mm) | b1<br>in (mm) | b2<br>in (mm) | c<br>in (mm) | s1<br>in (mm) | s2<br>in (mm) | m<br>lb (kg) |
|----|---------------------------|--------------|---------------|--------------|---------------|---------------|--------------|---------------|---------------|--------------|
| K1 | ESV303~4~B;<br>ESV303~6~B | 8.72 (221)   | 7.50 (190)    | 14.19 (360)  | 13.30 (338)   | 0.45 (11.4)   | 10.07 (256)  | 0.6 (15)      | 2.0 (50)      | 24 (10.9)    |
| K2 | ESV373~4~B;<br>ESV373~6~B | 8.72 (221)   | 7.50 (190)    | 17.19 (436)  | 16.30 (414)   | 0.45 (11.4)   | 10.07 (256)  | 0.6 (15)      | 2.0 (50)      | 31 (14.1)    |
| K3 | ESV453~4~B<br>ESV453~6~B  | 8.72 (221)   | 7.50 (190)    | 20.19 (513)  | 19.30 (490)   | 0.45 (11.4)   | 10.07 (256)  | 0.6 (15)      | 2.0 (50)      | 35 (15.9)    |

| Conduit Hole Dimensions | Type | N<br>in (mm) | P<br>in (mm) | P1<br>in (mm) | Q<br>in (mm) | S<br>in (mm) | S1<br>in (mm) |
|-------------------------|------|--------------|--------------|---------------|--------------|--------------|---------------|
|                         | K1   | 3.75 (95)    | 5.42 (137)   | 1.50 (38.1)   | 1.75 (44.4)  | 1.75 (44.4)  | 0.875 (22.2)  |
|                         | K2   | 3.75 (95)    | 5.42 (137)   | 1.50 (38.1)   | 1.75 (44.4)  | 1.75 (44.4)  | 0.875 (22.2)  |
|                         | K3   | 3.75 (95)    | 5.42 (137)   | 1.50 (38.1)   | 1.75 (44.4)  | 1.75 (44.4)  | 0.875 (22.2)  |



# Installation

## 3.1.3 NEMA 4X (IP65) Models



|    | Type                                                                                                                                                                                                                  | a<br>in (mm) | a1<br>in (mm) | b<br>in (mm) | b1<br>in (mm) | b2<br>in (mm) | c<br>in (mm) | s1<br>in (mm) | s2<br>in (mm) | m<br>lb (kg) |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|---------------|--------------|---------------|---------------|--------------|---------------|---------------|--------------|
| R1 | ESV371N01SX ; ESV751N01SX ;<br>ESV371N02YX ; ESV751N02YX ;<br>ESV371N04TX ; ESV751N04TX ;<br>ESV751N06TX ; ESV371N02SF ;<br>ESV751N02SF ; ESV371N04TF ;<br>ESV751N04TF ;                                              | 6.28 (160)   | 5.90 (150)    | 8.00 (203)   | 6.56 (167)    | 0.66 (17)     | 4.47 (114)   | 2.00 (51)     | 2.00 (51)     | 3.6 (1.63)   |
| R2 | ESV112N01SX ; ESV112N02YX ;<br>ESV152N02YX ; ESV112N04TX ;<br>ESV152N04TX ; ESV222N04TX ;<br>ESV152N06TX ; ESV222N06TX ;<br>ESV112N02SF ; ESV152N02SF ;<br>ESV112N04TF ; ESV152N04TF ;<br>ESV222N04TF ; ESV302N04TF ; | 6.28 (160)   | 5.90 (150)    | 8.00 (203)   | 6.56 (167)    | 0.66 (17)     | 6.31 (160)   | 2.00 (51)     | 2.00 (51)     | 5.9 (2.68)   |
| S1 | ESV222N02YX ; ESV222N02SF ;                                                                                                                                                                                           | 7.12 (181)   | 6.74 (171)    | 8.00 (203)   | 6.56 (167)    | 0.66 (17)     | 6.77 (172)   | 2.00 (51)     | 2.00 (51)     | 7.1 (3.24)   |
| T1 | ESV552N02TX- ; ESV752N02TX-<br>ESV752N04TX- ; ESV752N06TX-<br>ESV752N04TF- ;                                                                                                                                          | 8.04 (204)   | 7.56 (192)    | 10.00 (254)  | 8.04 (204)    | 0.92 (23)     | 8.00 (203)   | 4.00 (102)    | 4.00 (102)    | 10.98 (4.98) |
| V1 | ESV402N02TX ; ESV402N04TX ;<br>ESV552N04TX ; ESV402N06TX ;<br>ESV552N06TX ; ESV402N04TF ;<br>ESV552N04TF ;                                                                                                            | 8.96 (228)   | 8.48 (215)    | 10.00 (254)  | 8.04 (204)    | 0.92 (23)     | 8.00 (203)   | 4.00 (102)    | 4.00 (102)    | 11.58 (5.25) |
| W1 | ESV113N02TX- ; ESV153N02TX-<br>ESV113N04TX- ; ESV153N04TX-<br>ESV113N04TF- ; ESV153N04TF-<br>ESV113N06TX- ; ESV153N06TX-<br>ESV183N04TX- ; ESV183N04TF-<br>ESV183N06TX- ;                                             | 9.42 (240)   | 8.94 (228)    | 14.50 (368)  | 12.54 (319)   | 0.92 (24)     | 9.45 (241)   | 4.00 (102)    | 4.00 (102)    | 22.0 (10.0)  |
| X1 | ESV223N04TX- ; ESV223N04TF-<br>ESV223N06TX- ;                                                                                                                                                                         | 9.42 (240)   | 8.94 (228)    | 18.5 (470)   | 16.54 (420)   | 0.92 (24)     | 9.45 (241)   | 4.00 (102)    | 4.00 (102)    | 25.5 (11.6)  |

\_ = Last digit of part number:

C = N4X Indoor (convection cooled)

E = N4X In/Outdoor (convection cooled)

~ = Last digit of part number:

D = N4X Indoor (fan cooled)

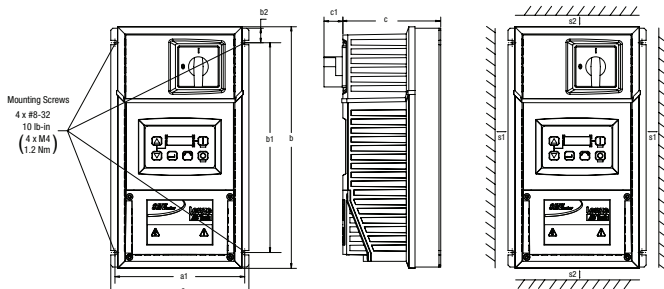
F = N4X In/Outdoor (fan cooled)

| Conduit Hole Dimensions |  | Type | N<br>in (mm) | P<br>in (mm) | Q<br>in (mm) | S<br>in (mm) | S1<br>in (mm) |
|-------------------------|--|------|--------------|--------------|--------------|--------------|---------------|
|                         |  | R1   | 3.14 (80)    | 2.33 (59)    | 1.50 (38)    | .88 (22)     | n/a           |
|                         |  | R2   | 3.14 (80)    | 4.18 (106)   | 1.50 (38)    | .88 (22)     | n/a           |
|                         |  | S1   | 3.56 (90)    | 4.63 (118)   | 1.50 (38)    | .88 (22)     | n/a           |
|                         |  | T1   | 4.02 (102)   | 5.00 (127)   | 1.85 (47)    | 1.06 (27)    | n/a           |
|                         |  | V1   | 4.48 (114)   | 5.00 (127)   | 1.85 (47)    | 1.06 (27)    | n/a           |
|                         |  | W1   | 4.71 (120)   | 5.70 (145)   | 2.00 (51)    | 1.375 (35)   | 1.125 (28)    |
|                         |  | X1   | 4.71 (120)   | 5.70 (145)   | 2.00 (51)    | 1.375 (35)   | 1.125 (28)    |





## 3.1.4 NEMA 4X (IP65) Models with Disconnect Switch



|     | Type                                                                                                                                                                                                                                | a<br>in<br>(mm)                                                                                                   | a1<br>in<br>(mm) | b<br>in<br>(mm) | b1<br>in<br>(mm) | b2<br>in<br>(mm) | c<br>in<br>(mm) | c1<br>in<br>(mm) | s1<br>in<br>(mm) | s2<br>in<br>(mm) | m<br>lb<br>(kg) |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------|-----------------|------------------|------------------|-----------------|------------------|------------------|------------------|-----------------|
| AA1 | ESV371N01SM_ ; ESV371N02YM_ ;<br>ESV371N02SL_ ; ESV371N04TM_ ;<br>ESV371N04TL_ ; ESV371N06TM_ ;<br>ESV751N01SM_ ; ESV751N02YM_ ;<br>ESV751N02SL_ ; ESV751N04TM_ ;<br>ESV751N04TL_ ; ESV751N06TM_ ;                                  | 6.28<br>(160)                                                                                                     | 5.90<br>(150)    | 10.99<br>(279)  | 9.54<br>(242)    | 0.66<br>(17)     | 4.47<br>(114)   | .86<br>(22)      | 2.00<br>(51)     | 2.00<br>(51)     | 4.7<br>(2.13)   |
|     | ESV112N01SM_ ; ESV112N02YM_ ;<br>ESV112N02SL_ ; ESV112N04TM_ ;<br>ESV112N04TL_ ; ESV152N02YM_ ;<br>ESV152N02SL_ ; ESV152N04TM_ ;<br>ESV152N04TL_ ; ESV152N06TM_ ;<br>ESV222N04TM_ ; ESV222N04TL_ ;<br>ESV222N06TM_ ; ESV302N04TL_ ; | 6.28<br>(160)                                                                                                     | 5.90<br>(150)    | 10.99<br>(279)  | 9.54<br>(242)    | 0.66<br>(17)     | 6.31<br>(160)   | .86<br>(22)      | 2.00<br>(51)     | 2.00<br>(51)     | 7.9<br>(3.58)   |
|     | AD1                                                                                                                                                                                                                                 | ESV222N02SL_ ; ESV222N02YM_ ;                                                                                     | 7.12<br>(181)    | 6.74<br>(171)   | 10.99<br>(279)   | 9.54<br>(242)    | 0.66<br>(17)    | 6.77<br>(172)    | .86<br>(22)      | 2.00<br>(51)     | 9.0<br>(4.08)   |
|     | AB1                                                                                                                                                                                                                                 | ESV552N02TM_ ; ESV752N02TM_ ;<br>ESV752N04TM_ ; ESV752N06TM_ ;<br>ESV752N04TL_ ;                                  | 8.04<br>(204)    | 7.56<br>(192)   | 13.00<br>(330)   | 11.04<br>(280)   | 0.92<br>(23)    | 8.00<br>(203)    | .86<br>(22)      | 4.00<br>(102)    | 13.9<br>(6.32)  |
|     | AC1                                                                                                                                                                                                                                 | ESV402N02TM_ ; ESV402N04TM_ ;<br>ESV552N04TM_ ; ESV402N06TM_ ;<br>ESV552N06TM_ ; ESV402N04TL_ ;<br>ESV552N04TL_ ; | 8.96<br>(228)    | 8.48<br>(215)   | 13.00<br>(330)   | 11.04<br>(280)   | 0.92<br>(23)    | 8.04<br>(204)    | .86<br>(22)      | 4.00<br>(102)    | 14.7<br>(6.66)  |
|     | AE1                                                                                                                                                                                                                                 | ESV113N04TM_ ; ESV153N04TM_ ;<br>ESV113N06TM_ ; ESV153N06TM_ ;                                                    | 9.42<br>(240)    | 8.94<br>(228)   | 14.50<br>(368)   | 12.54<br>(319)   | 0.92<br>(24)    | 9.45<br>(241)    | 0.73<br>(19)     | 4.00<br>(102)    | 23.0<br>(10.4)  |
| AF1 | ESV113N02TM_ ; ESV153N02TM_ ;<br>ESV113N04TL_ ; ESV153N04TL_ ;<br>ESV183N04TL_ ; ESV223N04TL_ ;<br>ESV183N04TM_ ; ESV223N04TM_ ;<br>ESV183N06TM_ ; ESV223N06TM_ ;                                                                   | 9.42<br>(240)                                                                                                     | 8.94<br>(228)    | 18.5<br>(470)   | 16.54<br>(420)   | 0.92<br>(24)     | 9.45<br>(241)   | 0.73<br>(19)     | 4.00<br>(102)    | 4.00<br>(102)    | 28.5<br>(12.9)  |

\_ = Last digit of part number: C = N4X Indoor (convection cooled)

~ = Last digit of part number: D = N4X Indoor (fan cooled)

| Conduit Hole Dimensions |  | Type | N<br>in (mm) | P<br>in (mm) | Q<br>in (mm) | S<br>in (mm) | S1<br>in (mm) |
|-------------------------|--|------|--------------|--------------|--------------|--------------|---------------|
|                         |  | AA1  | 3.14 (80)    | 2.33 (59)    | 1.50 (38)    | .88 (22)     | n/a           |
|                         |  | AA2  | 3.14 (80)    | 4.18 (106)   | 1.50 (38)    | .88 (22)     | n/a           |
|                         |  | AD1  | 3.56 (90)    | 4.63 (118)   | 1.50 (38)    | .88 (22)     | n/a           |
|                         |  | AB1  | 4.02 (102)   | 5.00 (127)   | 1.85 (47)    | 1.06 (27)    | n/a           |
|                         |  | AC1  | 4.48 (114)   | 5.00 (127)   | 1.85 (47)    | 1.06 (27)    | n/a           |
|                         |  | AE1  | 4.71 (120)   | 5.70 (145)   | 2.00 (51)    | 1.375 (35)   | 1.125 (28)    |
|                         |  | AF1  | 4.71 (120)   | 5.70 (145)   | 2.00 (51)    | 1.375 (35)   | 1.125 (28)    |



# Installation

## 3.2 Electrical Installation

### Installation After a Long Period of Storage



#### STOP!

Severe damage to the drive can result if it is operated after a long period of storage or inactivity without reforming the DC bus capacitors.

If input power has not been applied to the drive for a period of time exceeding three years (due to storage, etc), the electrolytic DC bus capacitors within the drive can change internally, resulting in excessive leakage current. This can result in premature failure of the capacitors if the drive is operated after such a long period of inactivity or storage.

In order to reform the capacitors and prepare the drive for operation after a long period of inactivity, apply input power to the drive for 8 hours prior to actually operating the motor.

### 3.2.1 Power Connections



#### STOP!

If the kVA rating of the AC supply transformer is greater than 10 times the input kVA rating of the drive(s), an isolation transformer or 2-3% input line reactor must be added to the line side of the drive(s).



#### DANGER! Hazard of electrical shock!

Circuit potentials up to 600 VAC are possible. Capacitors retain charge after power is removed. Disconnect power and wait at least three minutes before servicing the drive.

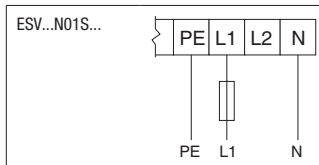


#### STOP!

- Verify mains voltage before connecting to drive.
- Do not connect mains power to the output terminals (U,V,W)! Severe damage to the drive will result.
- Do not cycle mains power more than once every two minutes. Damage to the drive may result.

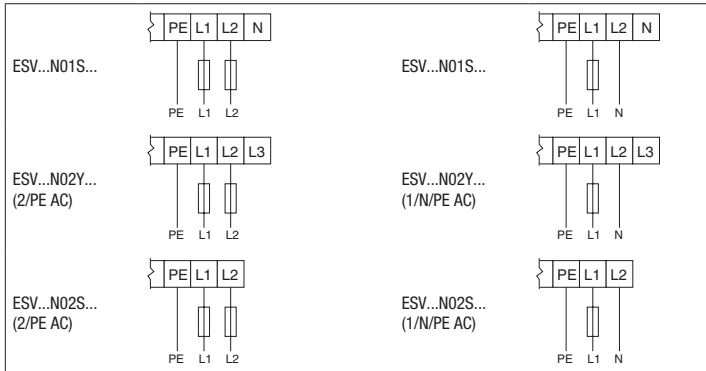
|  | Mains and Motor Terminations                                           |                          |                |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------|--------------------------|----------------|
|                                                                                   | Type                                                                   | Torque                   | Strip Length   |
|                                                                                   | <5HP                                                                   | 12 lb-in (1.3 Nm)        | 5/16 in (8mm)  |
|                                                                                   | ESV552xx2T, ESV752xx2T, ESV113xx4/6, ESV153xx4/6, ESV183xx6, ESV223xx6 | 16 lb-in (1.8 Nm)        | 5/16 in (8mm)  |
|                                                                                   | ESV552xx4Txx, ESV752xx4Txx, ESV552xx6Txx, ESV752xx6Txx                 | 12 lb-in (1.3Nm)         | 0.25 in (6mm)  |
|                                                                                   | ESV113xx2xxx, ESV153xx2xxx, ESV183xx4xxx, ESV223xx4xxx, ESV303xx4xxx   | 24 lb-in (2.7 Nm)        | 7/16 in (10mm) |
|                                                                                   | ESV373xx4xxx, ESV453xx4xxx                                             | 27 lb-in (3.05 Nm)       | 0.75 in (19mm) |
| Torque: N4X/IP65 Door Screws                                                      |                                                                        |                          |                |
|                                                                                   | N4X/IP65                                                               | 6-7 lb-in (0.67-0.79 Nm) | 0.25 in (6mm)  |

### 3.2.1.1 Mains Connection to 120VAC Single-Phase Supply

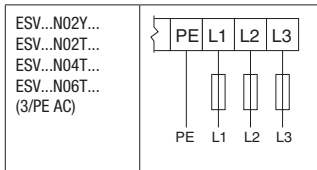




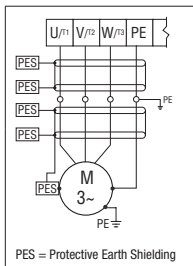
## 3.2.1.2 Mains Connection to 240VAC Single-Phase Supply



## 3.2.1.3 Mains Connection to Three-Phase Supply



## 3.2.1.4 Motor Connection



### WARNING!

If the cable connection between the drive and the motor has an in-line contactor or circuit breaker then the drive must be stopped prior to opening/closing the contacts. Failure to do so may result in Overcurrent trips and/or damage to the inverter.



### WARNING!

Leakage current may exceed 3.5 mA AC. The minimum size of the protective earth (PE) conductor shall comply with local safety regulations for high leakage current equipment.



### STOP!

In the case of a Spinning Motor:

To bring free-wheeling loads such as fans to a rest before starting the drive, use the DC injection braking function. Starting a drive into a freewheeling motor creates a direct short-circuit and may result in damage to the drive.

Confirm motor suitability for use with DC injection braking.

Consult parameter P110 for starting / restarting into spinning motors.



## Installation

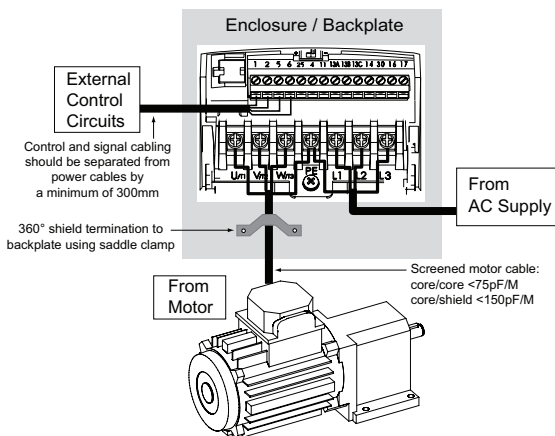
### 3.2.1.5 Installation Recommendations for EMC Compliance

For compliance with EN 61800-3 or other EMC standards, motor cables, line cables and control or communications cables must be shielded with each shield/screen clamped to the drive chassis. This clamp is typically located at the conduit mounting plate.

The EMC requirements apply to the final installation in its entirety, not to the individual components used. Because every installation is different, the recommended installation should follow these guidelines as a minimum. Additional equipment (such as ferrite core absorbers on power conductors) or alternative practices may be required to meet conformance in some installations.

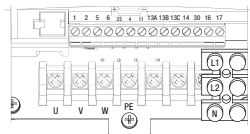
Motor cable should be low capacitance (core/core <75pF/m, core/shield <150pF/m). Filtered drives can meet the class A limits of EN 55011 and EN 61800-3 Category 2 with this type of motor cable up to 10 meters.

**NOTE:** Refer to Appendix A for recommended cable lengths. Any external line filter should have its chassis connected to the drive chassis by mounting hardware or with the shortest possible wire or braid.

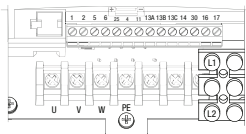


### 3.2.1.6 NEMA 4X (IP65) Input Terminal Block

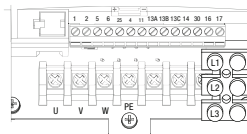
For NEMA 4X (IP65) models with integrated EMC filter and/or integrated line disconnect, the input terminal block is located on the right-hand side of the SMV inverter in the NEMA 4 X (IP65) enclosure. The single and three phase models are illustrated herein. Refer to paragraph 3.2.3 Control Terminals for pin out information.



Single Phase (2/PE) 120/240 VAC models (ESVxxxN01SMC) with integrated line disconnect



Single Phase (2/PE) 240 VAC models with Filter and/or integrated line disconnect



Three Phase (3/PE) models with Filter and/or integrated line disconnect



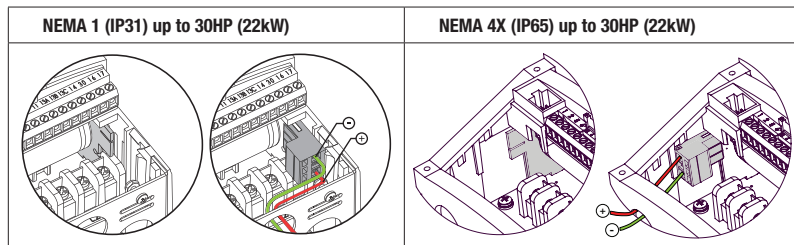
#### WARNING

Power remains present for up to 3 minutes on power input terminals (L1, L2 and L3) and output terminals (U, V and W) even when the disconnect switch is in the OFF position. Remove input power ahead of the drive and wait 3 minutes before removing the terminal cover.

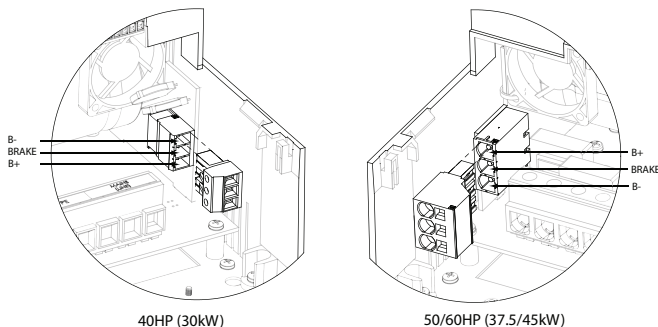


## 3.2.1.7 Dynamic Brake Connections

For NEMA 1 and NEMA 4X Drives rated up to 30HP (22kW) the Dynamic Brake connections are made as illustrated herein. Refer to the SMV Dynamic Brake Instructions (DBV01) for complete information.



The SMV 40...60HP (30...45kW) models include a dynamic brake transistor as standard and only require the connection of an external resistor kit for dynamic braking operation. The dynamic brake resistor connections for 40...60 Hp (30...45kW) drives are standard built-in connections as illustrated in the diagram below. In the 40Hp (30kW) model drives, the dynamic brake connector is on the right-hand side of the drive and the terminals from top to bottom are B-, BRAKE and B+. In the 50/60HP (37.5/45 kW) model drives, the dynamic brake connector is on the left-hand side of the drive and the terminals from top to bottom are B+, BRAKE and B-.



External resistor kits must be connected to terminals B+ and BRAKE (no connection to B-). Refer to the table herein for external resistor kit selection. Refer to parameter P189 for enabling the dynamic brake function in the 40...60HP (30...45kW) models.

| 400/480 VAC SMV Inverter |    |    | Resistor Kit            |           |           |          |
|--------------------------|----|----|-------------------------|-----------|-----------|----------|
| Type                     | Hp | kW | Resistance ( $\Omega$ ) | Power (W) | Catalog # | SAP#     |
| ESV303**4T**             | 40 | 30 | 23.5                    | 1020      | 841-013   | 13317724 |
| ESV373**4T**             | 50 | 37 | 17                      | 1400      | 841-015   | 13317626 |
| ESV453**4T**             | 60 | 45 | 17                      | 1400      | 841-015   | 13317626 |
| 600 VAC SMV Inverter     |    |    | Resistor Kit            |           |           |          |
| Type                     | Hp | kW | Resistance ( $\Omega$ ) | Power (W) | Catalog # | SAP#     |
| ESV303**6T**             | 40 | 30 | 35                      | 1070      | 841-014   | 13317624 |
| ESV373**6T**             | 50 | 37 | 24                      | 1560      | 841-016   | 13317628 |
| ESV453**6T**             | 60 | 45 | 24                      | 1560      | 841-016   | 13317628 |



# Installation

## 3.2.2 Fuses/Cable Cross-Sections



**NOTE:** Observe local regulations. Local codes may supersede these recommendations

**WARNING:** Use a FUSE \* for 240V drives requiring > 40A protection and for 400/480/600V drives requiring >32A protection.

| Type                        |                                                                                             | Recommendations |                                          |                                                            |                                     |       |
|-----------------------------|---------------------------------------------------------------------------------------------|-----------------|------------------------------------------|------------------------------------------------------------|-------------------------------------|-------|
|                             |                                                                                             | Fuse            | Miniature circuit breaker <sup>(1)</sup> | Fuse <sup>(2)</sup> or Breaker <sup>(3)</sup> (N. America) | Input Power Wiring (L1, L2, L3, PE) |       |
|                             |                                                                                             |                 |                                          |                                                            | [mm <sup>2</sup> ]                  | [AWG] |
| 120V<br>1~<br>(1/N/PE)      | ESV251N01SXB                                                                                | M10 A           | C10 A                                    | 10 A                                                       | 1.5                                 | 14    |
|                             | ESV371N01SXB, ESV371N01SX*                                                                  | M16 A           | C16 A                                    | 15 A                                                       | 2.5                                 | 14    |
|                             | ESV751N01SXB, ESV751N01SX*                                                                  | M25 A           | C25 A                                    | 25 A                                                       | 4                                   | 10    |
|                             | ESV112N01SXB, ESV112N01SX*                                                                  | M32 A           | C32 A                                    | 30A                                                        | 4                                   | 10    |
| 240V<br>1~<br>(2/PE)        | ESV251N01SXB, ESV251N02SXB, ESV371N01SXB, ESV371N02YXB, ESV371N02SF*                        | M10 A           | C10 A                                    | 10 A                                                       | 1.5                                 | 14    |
|                             | ESV751N01SXB, ESV751N02YXB, ESV751N02SF*                                                    | M16 A           | C16 A                                    | 15 A                                                       | 2.5                                 | 14    |
|                             | ESV112N02YXB, ESV112N02SFC, ESV112N01SXB, ESV112N01SX*                                      | M20 A           | C20 A                                    | 20 A                                                       | 2.5                                 | 12    |
|                             | ESV152N02YXB, ESV152N02SF*                                                                  | M25 A           | C25 A                                    | 25 A                                                       | 2.5                                 | 12    |
|                             | ESV222N02YXB, ESV222N02SF*                                                                  | M32 A           | C32A                                     | 30 A                                                       | 4                                   | 10    |
|                             | ESV371N02YXB, ESV751N02YXB, ESV371N02Y_*, ESV751N02Y_*                                      | M10 A           | C10 A                                    | 10 A                                                       | 1.5                                 | 14    |
| 240V<br>3~<br>(3/PE)        | ESV112N02YXB, ESV152N02YXB, ESV112N02TXB, ESV152N02TXB, ESV112N02Y_*, ESV152N02Y_*          | M16 A           | C16 A                                    | 12 A                                                       | 1.5                                 | 14    |
|                             | ESV222N02YXB, ESV222N02TXB, ESV222N02YX*                                                    | M20 A           | C20 A                                    | 20 A                                                       | 2.5                                 | 12    |
|                             | ESV402N02TXB, ESV402N02T_*                                                                  | M32 A           | C32 A                                    | 30 A                                                       | 4.0                                 | 10    |
|                             | ESV552N02TXB, ESV552N02T_*                                                                  | M40 A           | C40 A                                    | 35 A                                                       | 6.0                                 | 8     |
|                             | ESV752N02TXB, ESV752N02T_*                                                                  | M50 A           | * use Fuse only                          | 45 A *                                                     | 10                                  | 8     |
|                             | ESV113N02TXB, ESV113N02TX_*, ESV113N02TM_*                                                  | M80 A           | * use Fuse only                          | 80 A *                                                     | 16                                  | 6     |
|                             | ESV153N02TXB, ESV153N02TX_*, ESV153N02TM_*                                                  | M100 A          | * use Fuse only                          | 90 A *                                                     | 16                                  | 4     |
|                             | ESV371N04TXB, ...ESV222N04TXB, ESV371N04T_*, ...ESV222N04T_*, ESV371N04TF*, ...ESV222N04TF* | M10 A           | C10 A                                    | 10 A                                                       | 1.5                                 | 14    |
|                             | ESV302N04T_*                                                                                | M16 A           | C16 A                                    | 15 A                                                       | 2.5                                 | 14    |
|                             | ESV402N04TXB, ESV402N04T_*                                                                  | M16 A           | C16 A                                    | 20 A                                                       | 2.5                                 | 14    |
| 400V<br>or 480V<br>3~(3/PE) | ESV552N04TXB, ESV552N04T_*                                                                  | M20 A           | C20 A                                    | 20 A                                                       | 2.5                                 | 14    |
|                             | ESV752N04TXB, ESV752N04T_*                                                                  | M25 A           | C25 A                                    | 25 A                                                       | 4.0                                 | 10    |
|                             | ESV113N04TXB, ESV113N04T_*                                                                  | M40 A           | * use Fuse only                          | 40 A *                                                     | 4                                   | 8     |
|                             | ESV153N04TXB, ESV153N04T_*                                                                  | M50 A           | * use Fuse only                          | 50 A *                                                     | 10                                  | 8     |
|                             | ESV183N04TXB, ESV183N04T_*                                                                  | M63 A           | * use Fuse only                          | 70 A *                                                     | 10                                  | 6     |
|                             | ESV223N04TXB, ESV223N04T_*                                                                  | M80 A           | * use Fuse only                          | 80 A *                                                     | 16                                  | 6     |
|                             | ESV303N04TXB                                                                                | M100 A          | * use Fuse only                          | 100 A *                                                    | 25                                  | 4     |
|                             | ESV373N04TXB                                                                                | M125 A          | * use Fuse only                          | 125 A *                                                    | 35                                  | 2     |
|                             | ESV453N04TXB                                                                                | M160 A          | * use Fuse only                          | 150 A *                                                    | 35                                  | 1     |
|                             | ESV751N06TXB, ...ESV222N06TXB, ESV751N06T_*, ...ESV222N06T_*                                | M10 A           | C10 A                                    | 10 A                                                       | 1.5                                 | 14    |
| 600V<br>3~(3/PE)            | ESV402N06TXB, ESV402N06T_*                                                                  | M16 A           | C16 A                                    | 12 A                                                       | 1.5                                 | 14    |
|                             | ESV552N06TXB, ESV552N06T_*                                                                  | M16 A           | C16 A                                    | 15 A                                                       | 2.5                                 | 14    |
|                             | ESV752N06TXB, ESV752N06T_*                                                                  | M20 A           | C20 A                                    | 20 A                                                       | 2.5                                 | 12    |
|                             | ESV113N06TXB, ESV113N06TX_*, ESV113N06TM_*                                                  | M32 A           | C32 A                                    | 30 A                                                       | 4                                   | 10    |
|                             | ESV153N06TXB, ESV153N06TX_*, ESV153N06TM_*                                                  | M40 A           | * use Fuse only                          | 40 A *                                                     | 4                                   | 8     |
|                             | ESV183N06TXB, ESV183N06TX_*, ESV183N06TM_*                                                  | M50 A           | * use Fuse only                          | 50 A *                                                     | 6                                   | 8     |
|                             | ESV223N06TXB, ESV223N06TX_*, ESV223N06TM_*                                                  | M63 A           | * use Fuse only                          | 60 A *                                                     | 10                                  | 8     |
|                             | ESV303N06TXB                                                                                | M80 A           | * use Fuse only                          | 70 A *                                                     | 16                                  | 6     |
|                             | ESV373N06TXB                                                                                | M100 A          | * use Fuse only                          | 90 A *                                                     | 16                                  | 4     |
|                             | ESV453N06TXB                                                                                | M125 A          | * use Fuse only                          | 110 A *                                                    | 25                                  | 2     |



## Notes for Fuse and Cable Table:

- (1) Installations with high fault current due to large supply mains may require a type D circuit breaker.
- (2) UL Class CC or T fast-acting current-limiting type fuses, 200,000 AIC, preferred. Bussman KTK-R, JN or JJS or equivalent.
- (3) Thermomagnetic type breakers preferred.

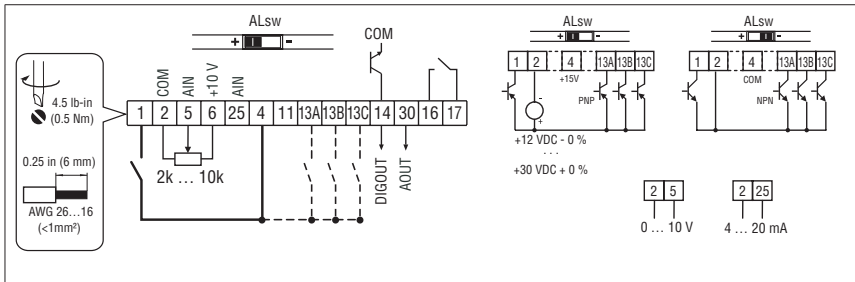
- \_ 11th digit of part number: F = Integral EMC Filter  
 L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)  
 M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)  
 X = No EMC Filter/ No Disconnect Switch  
 \* = Last digit of part number: C = N4X Indoor only (convection cooled)  
 E = N4X Indoor/Outdoor (convection cooled)  
 ~ = Last digit of part number: D = N4X Indoor only (fan cooled)  
 F = N4X Indoor/Outdoor (fan cooled)

Observe the following when using Ground Fault Circuit Interrupters (GFCIs):

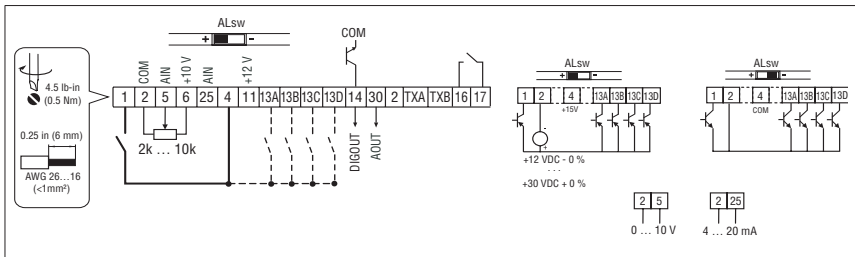
- Installation of GFCI only between supplying mains and controller.
- The GFCI can be activated by:
  - capacitive leakage currents between the cable screens during operation (especially with long, screened motor cables)
  - connecting several controllers to the mains at the same time
  - RFI filters

## 3.2.3 Control Terminals

### Control Terminal Strip for 0.33 - 10 HP (0.25 - 7.5 kW):



### Control Terminal Strip for 15HP (11 kW) and Greater Drives:



## NOTE

Control and communications terminals provide basic insulation when the drive is connected to a power system rated up to 300V between phase to ground (PE) and the applied voltage on terminals 16 and 17 is less than 250 VAC between phase to phase and ground (PE).



## Installation

### Control Terminal Strip Descriptions

| Terminal | Description                                  | Important                                       |
|----------|----------------------------------------------|-------------------------------------------------|
| 1        | Digital Input: Start/Stop                    | input resistance = 4.3k $\Omega$                |
| 2        | Analog Common                                |                                                 |
| 5        | Analog Input: 0...10 VDC                     | input resistance: >50 k $\Omega$                |
| 6        | Internal DC supply for speed pot             | +10 VDC, max. 10 mA                             |
| 25       | Analog Input: 4...20 mA                      | input resistance: 250 $\Omega$                  |
| 4        | Digital Reference/Common                     | +15 VDC / 0 VDC, depending on assertion level   |
| 11       | Internal DC supply for external devices      | +12 VDC, max. 50 mA                             |
| 13A      | Digital Input: Configurable with P121        | input resistance = 4.3k $\Omega$                |
| 13B      | Digital Input: Configurable with P122        |                                                 |
| 13C      | Digital Input: Configurable with P123        |                                                 |
| 13D*     | Digital Input: Configurable with P124        |                                                 |
| 14       | Digital Output: Configurable with P142, P144 | DC 24 V / 50 mA; NPN                            |
| 30       | Analog Output: Configurable with P150...P155 | 0...10 VDC, max. 20 mA                          |
| 2*       | Analog Common                                |                                                 |
| TXA*     | RS485 TxA                                    |                                                 |
| TXB*     | RS485 TxB                                    |                                                 |
| 16       | Relay output: Configurable with P140, P144   | AC 250 V / 3 A                                  |
| 17       |                                              | DC 24 V / 2 A ... 240 V / 0.22 A, non-inductive |

\* = Terminal is part of the terminal strip for the 15HP (11kW) and higher models only.

#### Assertion level of digital inputs

The digital inputs can be configured for active-high or active-low by setting the Assertion Level Switch (ALsw) and P120. If wiring to the drive inputs with dry contacts or with PNP solid state switches, set the switch and P120 to "High" (+). If using NPN devices for inputs, set both to "Low" (-). Active-high (+) is the default setting.

HIGH = +12 ... +30 V

LOW = 0 ... +3 V



#### NOTE

An **F\_AL** fault will occur if the Assertion Level switch (ALsw) position does not match the parameter P120 setting and P100 or any of the digital inputs (P121...P124) is set to a value other than 0.



## 4 Commissioning

### 4.1 Local Keypad & Display

| SMV Models: 0.33-10HP (0.25-7.5kW) | SMV Models: 15HP (11kW) and greater |
|------------------------------------|-------------------------------------|
|                                    |                                     |
| 4-Character Display                | 4-Character plus CTRL Display       |

| Display | START BUTTON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|         | In Local Mode (P100 = 0, 4, 6), this button will start the drive.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|         | STOP BUTTON                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|         | Stops the drive, regardless of which mode the drive is in.<br><b>WARNING!</b><br>When JOG is active, the STOP button will not stop the drive!                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | ROTATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|         | In Local Mode (P100 = 0, 4, 6), this selects the motor rotation direction:<br><ul style="list-style-type: none"> <li>- The LED for the present rotation direction (FWD or REV) will be on</li> <li>- Press R/F; the LED for the opposite rotation direction will blink</li> <li>- Press M within 4 seconds to confirm the change</li> <li>- The blinking direction LED will turn on, and the other LED will turn off</li> </ul> <p>When rotation direction is changed while the drive is running, the commanded direction LED will blink until the drive is controlling the motor in the selected direction.<br/>           Rotation is set in P112. When P112 = 0, rotation is forward only. When P112 = 1 rotation is forward and reverse.</p> |
|         | MODE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|         | Used to enter/exit the Parameter Menu when programming the drive and to enter a changed parameter value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|         | UP AND DOWN BUTTONS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|         | Used for programming and can also be used as a reference for speed, PID setpoint, or torque setpoint.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|         | When the ▲ and ▼ buttons are the active reference, the middle LED on the left side of the display will be on.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



## Commissioning

| Display                                                                           | INDICATING LEDs (on 4-character display)                                                                                                                                                                                                                   |                 |                                                                                                                                                                                                                                                     |                          |
|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
|   | FWD LED: Indicate the present rotation direction is forward. Refer to ROTATION description above.                                                                                                                                                          |                 |                                                                                                                                                                                                                                                     |                          |
|   | REV LED: Indicate the present rotation direction is reverse. Refer to ROTATION description above.                                                                                                                                                          |                 |                                                                                                                                                                                                                                                     |                          |
|   | AUTO LED: Indicates that the drive has been put into Auto mode from one of the TB13 inputs (P121...P124 set to 1...7). Indicates that PID mode is active (if PID mode is enabled). Indicates that sequencer mode is active (if sequencer mode is enabled). |                 |                                                                                                                                                                                                                                                     |                          |
|   | RUN LED: Indicates that the drive is running.                                                                                                                                                                                                              |                 |                                                                                                                                                                                                                                                     |                          |
|   | ▲ ▼ LED: Indicates that the ▲ ▼ are the active reference.                                                                                                                                                                                                  |                 |                                                                                                                                                                                                                                                     |                          |
|  | <b>NOTE</b><br>If the keypad is selected as the auto reference (P121...P124 is 6) and the corresponding TB-13 input is closed, the AUTO LED and ▲ ▼ LEDs will both be on.                                                                                  |                 |                                                                                                                                                                                                                                                     |                          |
| <b>FUNCTIONS THAT FOLLOW ARE APPLICABLE TO SMV DRIVES 15HP (11kW) AND HIGHER</b>  |                                                                                                                                                                                                                                                            |                 |                                                                                                                                                                                                                                                     |                          |
|   | <b>CTRL</b><br>The CTRL pushbutton selects the start and speed reference control sources for the drive.<br>Press  mode button to accept the new control mode selection.   |                 |                                                                                                                                                                                                                                                     |                          |
|                                                                                   | <b>CTRL LEDs</b>                                                                                                                                                                                                                                           |                 | <b>START CONTROL</b>                                                                                                                                                                                                                                | <b>REFERENCE CONTROL</b> |
|                                                                                   |                                                                                                                                                                           | [LOCAL] [MAN]   | Keypad                                                                                                                                                                                                                                              | P101 Settings            |
|                                                                                   |                                                                                                                                                                           | [LOCAL] [AUTO]  | Keypad                                                                                                                                                                                                                                              | Terminal 13x Settings    |
|                                                                                   |                                                                                                                                                                           | [REMOTE] [MAN]  | Terminal Strip                                                                                                                                                                                                                                      | P101 Settings            |
|                                                                                   |                                                                                                                                                                          | [REMOTE] [AUTO] | Terminal Strip                                                                                                                                                                                                                                      | Terminal 13x Settings    |
|                                                                                   | If P100 = 6 the CTRL button is used to toggle start control between the terminal strip [REMOTE] and the keypad [LOCAL]                                                                                                                                     |                 | - REM/LOC LED indicating the present start control source is ON<br>- Press [CTRL]; the LED for other start control source will blink<br>- Press [M] within 4 sec to confirm the change<br>- Blinking LED will turn ON (the other LED will turn OFF) |                          |
|                                                                                   | If P113 = 1 the CTRL button is used to toggle reference control between the TB-13x setup [AUTO] and P101 [MANUAL]                                                                                                                                          |                 | - AUT/MAN LED indicating present reference control is ON<br>- Press [CTRL]; the other reference control will blink<br>- Press [M] within 4 sec to confirm change<br>- Blinking LED will turn ON (the other LED will turn OFF)                       |                          |
|                                                                                   | If P100 = 6 and P113 = 1, it is possible to change the start and reference control sources at the same time                                                                                                                                                |                 |                                                                                                                                                                                                                                                     |                          |



|         |                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Display | START CONTROL                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | The REMOTE/LOCAL LEDs indicate the current start control source. If the start control source is a remote keypad or the network, then both LEDs will be OFF.                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | REFERENCE CONTROL                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | The AUTO/MANUAL LEDs indicate the current reference control source.                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | IF P113 = 0 or 2, the AUTO/MANUAL LEDs will match the AUTO LED on the 4-character display. IF P113 = 0 and no AUTO reference has been setup on the terminal strip, the MANUAL LED will turn ON and the AUTO LED will turn OFF.                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | IF P113 = 1, the AUTO/MANUAL LEDS show the commanded reference control source as selected by the [CTRL] button. If the [CTRL] button is used to set the reference control source to AUTO but no AUTO reference has been setup on the terminal strip, reference control will follow P101 but the AUTO LED will remain ON. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | UNITS LEDs                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | HZ: current display value is in Hz                                                                                                                                                                                                                                                                                       | In Speed mode, if P178 = 0 then HZ LED will be ON. If P178 > 0, the Units LEDs follow the setting of P177 when the drive is in run (non-programming) mode.<br><br>In Torque mode, the HZ LED will be ON when the drive is in run (non-programming) mode.<br><br>In Pid mode, the Units LEDs follow the setting of P203 when the drive is in run (non-programming) mode.<br><br>If P179 > 0, the Units LEDs will show the unit of the diagnostic parameter that is being displayed. |
|         | ‰: current display value is in ‰                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | RPM: current display value is in RPM                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | AMPS: current display value is in Amps                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|         | /UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

## 4.2 Drive Display and Modes of Operation

### Speed Mode Display

In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive's output frequency.

### PID Mode Display

When the PID mode is enabled and active, the normal run display shows the actual PID setpoint. When PID mode is not active, the display returns to showing the drive's output frequency.

### Torque Mode Display

When the drive is operating in Vector Torque mode, the normal run display shows the drive's output frequency.

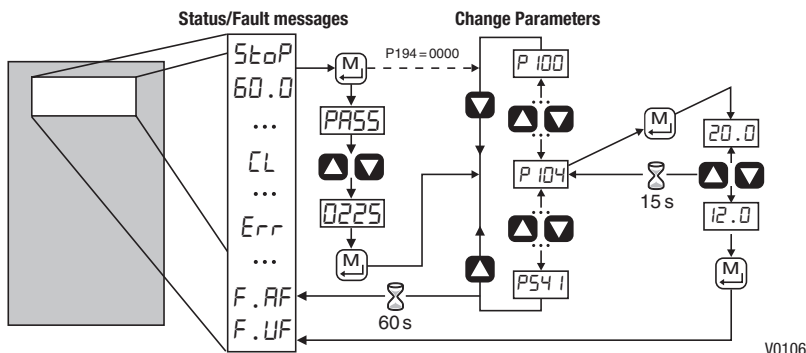
### Alternate (Run-Screen) Display

When P179 (Run Screen Display) is set to a value other than 0, one of the diagnostic parameters (P501...P599) is displayed. Example: if P179 is set to 1, then diagnostic parameter P501 (Software version) is displayed. If P179 = 2, then P502 (Drive ID) is displayed.



# Commissioning

## 4.3 Parameter Setting



## 4.4 Electronic Programming Module (EPM)

The EPM contains the drives operational memory. Parameter settings are stored in the EPM and setting changes are made to the "User settings" in the EPM.

An optional EPM Programmer (model EEPROM1RA) is available that allows:

- An EPM to be copied directly to another EPM.
- An EPM to be copied to the memory of the EPM Programmer.
- Stored files can be modified in the EPM Programmer.
- Stored files can be copied to another EPM.



EPM Module  
in SMV Drive

As the EPM Programmer is battery operated, parameter settings can be copied to an EPM and inserted into a drive without power being applied to the drive. This means that the drive will be fully operational with the new settings on the next application of power.

Additionally, when the drives parameter settings are burned into an EPM with the EPM Programmer, the settings are saved in two distinct locations; the "User settings" and the "OEM default settings". While the User settings can be modified in the drive, the OEM settings cannot. Thus, the drive can be reset not only to the "factory" drive default settings (shown in this manual), but can be set to the Original Machine settings as programmed by the OEM.

The user area contents of the EPM are what are copied into the OEM space by the EPM programmer. When parameter modifications are made to the drive and then a copy made via the EPM Programmer, these are the settings that will be available by the OEM selections from P199. The EPM Programmer is the only way to load the OEM area of the EPM.

While the EPM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing EPM will trigger an **F\_F I** fault)



## 4.5 Parameter Menu

### 4.5.1 Basic Setup Parameters

| Code         |                           | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | IMPORTANT                                                                                                                                                                                                                                                                                                                  |
|--------------|---------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.          | Name                      | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                            |
| <b>P 100</b> | Start Control Source      | 0                 | 0 Local Keypad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Use RUN button on front of drive to start                                                                                                                                                                                                                                                                                  |
|              |                           |                   | 1 Terminal Strip                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Use start/stop circuit wired into the terminal strip. Refer to section 3.2.3                                                                                                                                                                                                                                               |
|              |                           |                   | 2 Remote Keypad Only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Use RUN button on optional Remote Keypad to start                                                                                                                                                                                                                                                                          |
|              |                           |                   | 3 Network Only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>Start command must come from network (Modbus, CANopen, etc)</li> <li>SMV models &lt;15HP (11kW) require optional communication module (refer to the network module documentation).</li> <li>Must also set one of the TB-13 inputs to 9 (Network Enable); see P121...P124</li> </ul> |
|              |                           |                   | 4 Terminal Strip or Local Keypad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Allows start control to be switched between terminal strip and local keypad using one of the TB-13 inputs. See note below.                                                                                                                                                                                                 |
|              |                           |                   | 5 Terminal Strip or Remote Keypad                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Allows start control to be switched between terminal strip and optional remote keypad using one of the TB-13 inputs. See Note below                                                                                                                                                                                        |
|              |                           |                   | 6 CTRL button select                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Allows start control to be switched between terminal strip and local keypad using the CTRL button.<br><b>NOTE:</b> P100 Selection 6 is applicable to SMV 15HP (11kW) and higher models only.                                                                                                                               |
|              |                           |                   | <b>WARNING!</b><br>P100 = 0 disables TB-1 as a STOP input! STOP circuitry may be disabled if parameters are reset back to defaults (see P199)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | <b>NOTE</b> <ul style="list-style-type: none"> <li>P100 = 4, 5: To switch between control sources, one of the TB-13 inputs (P121...P124) must be set to 08 (Control Select);<br/>TB-13x OPEN (or not configured): Terminal strip control</li> <li>TB-13x CLOSED: Local (P100 = 4) or Remote (P100 = 5) keypad</li> <li>P100 = 0, 1, 4, 6: Network can take control if P121...P124 = 9 and the corresponding TB-13x input is CLOSED.</li> <li>The STOP button on the front of the drive is always active except in JOG mode.</li> <li>TB-1 is an active STOP input if P100 is set to a value other than 0.</li> <li>An <b>F<sub>RL</sub></b> fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and P100 is set to a value other than 0.</li> </ul> |                                                                                                                                                                                                                                                                                                                            |
| <b>P 101</b> | Standard Reference Source | 0                 | 0 Keypad (Local or Remote)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Selects the default speed or torque reference when no Auto Reference is selected using the TB-13 inputs.                                                                                                                                                                                                                   |
|              |                           |                   | 1 0-10 VDC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 2 4-20 mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 3 Preset #1 (P131)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 4 Preset #2 (P132)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 5 Preset #3 (P133)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 6 Network                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 7 Preset Sequence Segment #1 (P710)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Selections 7, 8 & 9 are not valid for PID setpoint or torque reference.                                                                                                                                                                                                                                                    |
|              |                           |                   | 8 Preset Sequence Segment #2 (P715)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                            |
|              |                           |                   | 9 Preset Sequence Segment #3 (P720)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                            |



# Commissioning

| Code                                                                                                                                                                                |                                                                                                                                            | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                |      | IMPORTANT                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                                                                                                                                                                                 | Name                                                                                                                                       | Default           | Selection                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                |      |                                                                                                                                                                                                                          |
| P 102                                                                                                                                                                               | Minimum Frequency                                                                                                                          | 0.0               | 0.0                                                                                                                                                                                                                                                                                                                                                               | {Hz}                                                                                                                                                                                                                                                                           | P103 | <ul style="list-style-type: none"><li>P102, P103 are active for all speed references</li><li>When using an analog speed reference, also see P160, P161</li></ul>                                                         |
| P 103                                                                                                                                                                               | Maximum Frequency                                                                                                                          | 60.0              | 7.5                                                                                                                                                                                                                                                                                                                                                               | {Hz}                                                                                                                                                                                                                                                                           | 500  |                                                                                                                                                                                                                          |
|                                                                                                                                                                                     |                                                                                                                                            |                   | <b>NOTE</b> <ul style="list-style-type: none"><li>P103 cannot be set below Minimum Frequency (P102)</li><li>To set P103 above 120 Hz:<ul style="list-style-type: none"><li>Scroll up to 120 Hz; display shows <b>H.Fr</b> (flashing).</li><li>Release ▽ button and wait one second.</li><li>Press ▽ button again to continue increasing P103.</li></ul></li></ul> |                                                                                                                                                                                                                                                                                |      |                                                                                                                                                                                                                          |
| <b>WARNING!</b><br>Consult motor/machine manufacturer before operating above rated frequency. Overspeeding the motor/machine may cause damage to equipment and injury to personnel! |                                                                                                                                            |                   |                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                |      |                                                                                                                                                                                                                          |
| P 104                                                                                                                                                                               | Acceleration Time 1                                                                                                                        | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                               | {s}                                                                                                                                                                                                                                                                            | 3600 | <ul style="list-style-type: none"><li>P104 = time of frequency change from 0 Hz to P167 (base frequency)</li><li>P105 = time of frequency change from P167 to 0 Hz</li><li>For S-ramp accel/decel, adjust P106</li></ul> |
| P 105                                                                                                                                                                               | Deceleration Time 1                                                                                                                        | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                               | {s}                                                                                                                                                                                                                                                                            | 3600 |                                                                                                                                                                                                                          |
|                                                                                                                                                                                     | EXAMPLE: IF P103 = 120 Hz, P104 = 20.0 s and P167 (base frequency) = 60 Hz; then the rate of frequency change from 0 Hz to 120 Hz = 40.0 s |                   |                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                |      |                                                                                                                                                                                                                          |
| P 106                                                                                                                                                                               | S-Ramp Integration Time                                                                                                                    | 0.0               | 0.0                                                                                                                                                                                                                                                                                                                                                               | {s}                                                                                                                                                                                                                                                                            | 50.0 | <ul style="list-style-type: none"><li>P106 = 0.0: Linear accel/decel ramp</li><li>P106 &gt; 0.0: Adjusts S-ramp curve for smoother ramp</li></ul>                                                                        |
| P 107 <sup>(1)</sup>                                                                                                                                                                | Line Voltage Selection                                                                                                                     | 1*                | 0                                                                                                                                                                                                                                                                                                                                                                 | Low (120, 200, 400, 480VAC)                                                                                                                                                                                                                                                    |      | * The default setting is 1 for all drives except when using "Reset to 50Hz default settings" (Parameter P199, selection 4) with 480V models. In this case, the default setting is 0.                                     |
|                                                                                                                                                                                     |                                                                                                                                            |                   | 1                                                                                                                                                                                                                                                                                                                                                                 | High (120, 240, 480, 600VAC)                                                                                                                                                                                                                                                   |      |                                                                                                                                                                                                                          |
| P 108                                                                                                                                                                               | Motor Overload                                                                                                                             | 100               | 30                                                                                                                                                                                                                                                                                                                                                                | {%}                                                                                                                                                                                                                                                                            | 100  | P108 = $\frac{\text{motor current rating}}{\text{SMV output rating}} \times 100$<br>Example: if motor = 3amps and SMV = 4amps, then P108 = 75%                                                                           |
|                                                                                                                                                                                     |                                                                                                                                            |                   |                                                                                                                                                                                                                                                                                                                                                                   | <b>NOTE</b><br>Do not set above rated motor current as listed on the motor dataplate. The motor thermal overload function of the SMV is UL approved as a motor protection device. Cycling power after an overload fault could result in significantly reducing the motor life. |      |                                                                                                                                                                                                                          |
| P 109                                                                                                                                                                               | Motor Overload Type                                                                                                                        | 0                 | 0 Speed Compensation                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                |      | <br>V0108                                                                                                                                                                                                                |
|                                                                                                                                                                                     |                                                                                                                                            |                   | 1 No Speed Compensation<br>Example: Motor is cooled by forced ventilation as apposed to shaft mounted, self cooling fans.                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                |      |                                                                                                                                                                                                                          |

(1) Any changes to this parameter will not take effect until the drive is stopped.



| Code                                                                             |                                                                                                                                                                                                              | Possible Settings                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IMPORTANT                                                                                                      |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| No.                                                                              | Name                                                                                                                                                                                                         | Default                                                                           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                |
| P110                                                                             | Start Method                                                                                                                                                                                                 | 0                                                                                 | 0 Normal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Drive will automatically start when power is applied.                                                          |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 1 Start on Power-up                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | When start command is applied, drive will apply DC braking according to P174, P175 prior to starting the motor |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 2 Start with DC Brake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Drive will automatically restart after faults, or when power is applied.                                       |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 3 Auto Restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Combines settings 2 and 3                                                                                      |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 4 Auto Restart with DC Brake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | • Drive will automatically restart after faults, or when power is applied.                                     |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 5 Flying Start/Restart - Type 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | • After 3 failed attempts, drive will Auto Restart with DC brake.                                              |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 6 Flying Start/Restart - Type 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | • P110 = 5, 7: Performs speed search, starting at Max Frequency (P103)                                         |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 7 Flying Start /Restart - Type 2 for 2-pole motors requiring a flying restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | • P110 = 6, 8: Performs speed search, starting at the last output frequency prior to faulting or power loss    |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 8 Flying Start/Restart - Type 2 for 2-pole motors requiring a flying restart                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | • If P111 = 0, a flying START is performed when a start command is applied.                                    |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                |
|                                                                                  |                                                                                                                                                                                                              |  | <b>NOTE</b> <ul style="list-style-type: none"><li>• P110 = 0, 2: Start command must be applied at least 2 seconds after power-up; <b>F<sub>UF</sub></b> fault will occur if start command is applied too soon.</li><li>• P110 = 1, 3...6: For automatic start/restart, the start source must be the terminal strip and the start command must be present.</li><li>• P110 = 2, 4...6: If P175=999.9, dc braking will be applied for 15s.</li><li>• P110 = 3...6: Drive will attempt 5 restarts; if all restart attempts fail, drive displays <b>LC</b> (fault lockout) and requires manual reset.</li><li>• P110 = 5, 6: If drive cannot catch the spinning motor, drive will trip into <b>F<sub>rF</sub></b> fault.</li><li>• P110 = 5, 6: If drive trips into <b>F<sub>UF</sub></b> fault, try P110 = 7 or 8.</li></ul> |                                                                                                                |
|  | <b>WARNING!</b><br>Automatic starting/restarting may cause damage to equipment and/or injury to personnel! Automatic starting/restarting should only be used on equipment that is inaccessible to personnel. |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                |
| P111                                                                             | Stop Method                                                                                                                                                                                                  | 0                                                                                 | 0 Coast                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Drive's output will shut off immediately upon a stop command, allowing the motor to coast to a stop            |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 1 Coast with DC Brake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | The drive's output will shut off and then the DC Brake will activate (refer to P174, P175)                     |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 2 Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | The drive will ramp the motor to a stop according to P105 or P126.                                             |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 3 Ramp with DC Brake                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The drive will ramp the motor to 0 Hz and then the DC Brake will activate (refer to P174, P175)                |
| P112                                                                             | Rotation                                                                                                                                                                                                     | 0                                                                                 | 0 Forward Only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | If PID mode is enabled, reverse direction is disabled (except for Jog).                                        |
|                                                                                  |                                                                                                                                                                                                              |                                                                                   | 1 Forward and Reverse                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                |



## Commissioning

| Code        |                                      | Possible Settings                                                                 |                                                                              | IMPORTANT                                                                                                                                                                                                                                                             |
|-------------|--------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.         | Name                                 | Default                                                                           | Selection                                                                    |                                                                                                                                                                                                                                                                       |
| <b>P113</b> | Auto/Manual Control                  | 0                                                                                 | 0 Terminal Strip Control                                                     | The reference is dictated by the settings and state of the TB-13x terminals. If no AUTO reference has been setup on the terminal strip then reference control is dictated by P101.                                                                                    |
|             |                                      |                                                                                   | 1 Auto/Manual (CTRL button select)                                           | Allows the reference to be switched between auto and manual using the CTRL pushbutton on the drive keypad. If the CTRL pushbutton has selected AUTO reference but no AUTO reference has been setup on the terminal strip, then reference control is dictated by P101. |
|             |                                      |                                                                                   | 2 Manual Control Only                                                        | Reference is dictated by P101 regardless of any AUTO source that may be selected by the TB-13x terminals.                                                                                                                                                             |
|             |                                      |  | <b>NOTE</b><br>P113 is applicable to SMV 15HP (11kW) and higher models only. |                                                                                                                                                                                                                                                                       |
| <b>P115</b> | MOP Speed Initialization at Power-Up | 0                                                                                 | 0 Set to last MOP speed at power up                                          | Output frequency at power-up = last MOP speed                                                                                                                                                                                                                         |
|             |                                      |                                                                                   | 1 Set to 0.0Hz at power up                                                   | Output frequency at power-up = 0Hz                                                                                                                                                                                                                                    |
|             |                                      |                                                                                   | 2 Set to Preset #3 (P133) at power up                                        | Output frequency at power-up = P133                                                                                                                                                                                                                                   |





## 4.5.2 I/O Setup Parameters

| Code                                                                                                                                                                                                                                                                                                                          |                                                                                                                 | Possible Settings |                                                 | IMPORTANT                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                                                                                                                                                                                                                                                                                                                           | Name                                                                                                            | Default           | Selection                                       |                                                                                                                                                                                             |
| P 120                                                                                                                                                                                                                                                                                                                         | Assertion Level                                                                                                 | 2                 | 1 Low                                           | P120 and the Assertion Level switch must both match the desired assertion level unless P100, P121...P124 are all set to 0. Otherwise an F.AL fault will occur.                              |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 2 High                                          |                                                                                                                                                                                             |
| P 121                                                                                                                                                                                                                                                                                                                         | TB-13A Digital Input                                                                                            | 0                 | 0 None                                          | Disables input                                                                                                                                                                              |
| P 122                                                                                                                                                                                                                                                                                                                         | TB-13B Digital Input<br>(Priority > TB13A)<br>Same as TB13A except:<br>3 = Preset #2<br>23 = Seq Seg, #2        |                   | 1 AUTO Reference: 0-10 VDC                      | For frequency mode, see P160...P161,<br>For PID mode, see P204...P205,<br>For vector torque mode, see P330                                                                                  |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 2 AUTO Reference: 4-20 mA                       | For frequency mode see P131...P137,<br>For PID mode, see P231...P233,<br>For torque mode see, P331...P333                                                                                   |
| P 123                                                                                                                                                                                                                                                                                                                         | TB-13C Digital Input<br>(Priority > TB13B, A)<br>Same as TB13A except:<br>3 = Preset #3<br>23 = Seq Seg, #4     |                   | 3 AUTO Reference: Preset #1                     | • Normally open: Close input to increase or decrease speed, PID or torque setpoint.<br>• MOP Up is not active while in STOP                                                                 |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | * 13D: 3 = Reserved                             |                                                                                                                                                                                             |
| P 124                                                                                                                                                                                                                                                                                                                         | TB-13D* Digital Input<br>(Priority > TB13C, B, A)<br>Same as TB13A except:<br>3 = Preset #4<br>23 = Seq Seg, #8 |                   | 4 AUTO Reference: MOP Up                        | Use when P100 = 4, 5 to switch between terminal strip control and local or remote keypad control.<br>Required to start the drive through the network.<br>Open = Forward    Closed = Reverse |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 5 AUTO Reference: MOP Down                      |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 6 AUTO Reference: Keypad                        | Refer to Note for typical circuit                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 7 AUTO Reference: Network                       |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 8 Control Select                                | Jog Forward speed = P134<br>Jog Reverse speed = P135<br>⚠ Active even if P112 = 0                                                                                                           |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 9 Network Enable                                |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 10 Reverse Rotation                             | Refer to P174; close input to override P175                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 11 Start Forward                                |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 12 Start Reverse                                | Close to reset fault                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 13 Run Forward                                  |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 14 Run Reverse                                  | Normally open circuit; close to trip                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 15 Jog Forward                                  |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 16 Jog Reverse                                  | Transition from non-asserted to asserted state                                                                                                                                              |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 17 Accel/Decel #2                               |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 18 DC Brake                                     |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 19 Auxiliary Ramp to Stop                       |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 20 Clear Fault                                  |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 21 External Fault <b>F<sub>EF</sub></b>         |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 22 Inverse External Fault <b>F<sub>EF</sub></b> |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 23 AUTO Ref: Sequence Segment #1                |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 24 Start Sequence                               |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 25 Step Sequence                                |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   | 26 Suspend Sequence                             |                                                                                                                                                                                             |
|                                                                                                                                                                                                                                                                                                                               |                                                                                                                 |                   |                                                 |                                                                                                                                                                                             |
| <div></div> <b>WARNING</b><br>Jog overrides all STOP commands! To stop the drive while in Jog mode, the Jog input must be deactivated or a fault condition induced.                                                                         |                                                                                                                 |                   |                                                 |                                                                                                                                                                                             |
| <div></div> <b>WARNING</b><br>If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration). |                                                                                                                 |                   |                                                 |                                                                                                                                                                                             |



# Commissioning

| Code                                                                                                                                                 | Possible Settings                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                               | IMPORTANT                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                                                                                                                                                  | Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Default Selection                                                                                                                                                             |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <div><div><div><div><div></div><div>i</div></div></div></div></div>                                                                                  | <div><div><div>NOTE</div><div><ul style="list-style-type: none"><li>When input is activated, settings 1...7 override P101</li><li>When TB-13A...TB-13D are configured for Auto References other than MOP, TB-13D overrides TB-13C, TB-13C overrides TB-13B and TB-13B overrides TB-13A. Any other Auto Reference will have priority over MOP.</li><li>Settings 10...14 are only valid in Terminal Strip mode (P100 = 1, 4, 5, 6)</li><li>If Start/Run/Jog Forward and Start/Run/Jog Reverse are both activated, drive will STOP</li><li>If Jog input is activated while drive is running, the drive will enter Jog mode; when Jog input is deactivated, drive will STOP</li><li>An <b>F<sub>AL</sub></b> fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and any of the digital inputs (P121...P124) are set to a value other than 0.</li><li>An <b>F<sub>IL</sub></b> fault will occur under the following conditions:<ul style="list-style-type: none"><li>TB-13A...TB-13D settings are duplicated (each setting, except 0, 3 and 23, can only be used once)</li><li>One input is set to "MOP Up" and another is not set to "MOP Down", or vice-versa.</li><li>One input is set to 10 and another input is set to 11...14.</li><li>One input is set to 11 or 12 and another input is set for 13 or 14.</li></ul></li><li>Typical control circuits are shown below:<ul style="list-style-type: none"><li>If any input is set to 10, 12 or 14, P112 must be set to 1 for Reverse action to function.</li></ul></li></ul></div></div><div><div><div><div>Run / Stop<br/>with Direction<br/>P121 = 10</div><div><div><div>1</div><div>4</div><div>13A</div></div><div><div>STOP</div><div>FWD</div></div><div><div>RUN</div><div>REV</div></div></div></div><div><div><div>Start Forward /<br/>Start Reverse<br/>P121 = 11, P122 = 12</div><div><div><div>1</div><div>4</div><div>13A</div><div>13B</div></div><div><div>STOP</div><div>FWD</div></div><div><div>REV</div></div></div></div><div><div><div>Run Forward /<br/>Run Reverse<br/>P121 = 13, P122 = 14</div><div><div><div>1</div><div>4</div><div>13A</div><div>13B</div></div><div><div>RUN FWD</div><div>RUN REV</div></div></div></div></div></div></div></div></div> |                                                                                                                                                                               |                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <div><div><div><div><div>P 125</div><div>Acceleration Time 2</div><div>20.0</div><div>0.0</div><div>{s}</div><div>3600</div></div></div></div></div> | <div><div><div><div><div>P 126</div><div>Deceleration Time 2</div><div>20.0</div><div>0.0</div><div>{s}</div><div>3600</div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <div><div><div><div><div>P 127</div><div>Deceleration Time for Auxiliary Ramp to Stop</div><div>20.0</div><div>0.0</div><div>{s}</div><div>3600</div></div></div></div></div> | <div><div><div><div><div>P 129</div><div>Automatic Accel/Decel rate switch threshold</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>1000</div></div></div></div></div> | <div><div><div><div><div><div><div><div><div><div></div><div>P124 = 17</div></div></div><div><div>For S-ramp accel/decel, adjust P106</div></div></div></div><div><div><div><div><div><div><div><div><div></div><div>P124 = 19.</div></div></div><div><div>For S-ramp accel/decel, adjust P106</div></div><div><div>Once executed, this ramp time has priority over P105 and P126.</div></div></div></div></div></div></div><div><div><div><div><div><div><div><div><div></div><div>If Actual Frequency &lt; P129 Use Accel/decel time #2 (P125/P126)</div></div></div><div><div><div><div><div><div></div><div>If Actual Frequency &gt; P129 Use Accel/decel time #1 (P104/P105)</div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div> |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <div><div><div><div><div>P 131</div><div>Preset Speed #1</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div>      | <div><div><div><div><div>P 132</div><div>Preset Speed #2</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <div><div><div><div><div>P 133</div><div>Preset Speed #3</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div>                               | <div><div><div><div><div>P 134</div><div>Preset Speed #4</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div>                              | <div><div><div><div><div>P 135</div><div>Preset Speed #5</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <div><div><div><div><div>P 136</div><div>Preset Speed #6</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div> | <div><div><div><div><div>P 137</div><div>Preset Speed #7</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div> | <div><div><div><div><div>P 138</div><div>Preset Speed #8</div><div>0.0</div><div>0.0</div><div>{Hz}</div><div>500</div></div></div></div></div> | <div><div><div><div><div><div><div><div><div><div></div><div>PRESET SPEED</div></div><div><div>13A</div><div>13B</div><div>13C</div><div>13D</div></div></div></div><div><div><div><div><div>1</div><div>X</div><div>--</div><div>--</div><div>--</div></div></div><div><div><div><div><div>2</div><div>--</div><div>X</div><div>--</div><div>--</div></div></div><div><div><div><div><div>3</div><div>--</div><div>--</div><div>X</div><div>--</div></div></div><div><div><div><div><div>4</div><div>X</div><div>X</div><div>--</div><div>--</div></div></div><div><div><div><div><div>4 (alternate)</div><div>--</div><div>--</div><div>--</div><div>X</div></div></div><div><div><div><div><div>5</div><div>X</div><div>--</div><div>X</div><div>--</div></div></div><div><div><div><div><div>6</div><div>--</div><div>X</div><div>X</div><div>--</div></div></div><div><div><div><div><div>7</div><div>X</div><div>X</div><div>X</div><div>--</div></div></div><div><div><div><div><div>8 (alternate)</div><div>--</div><div>X</div><div>--</div><div>X</div></div></div><div><div><div><div><div>8 (alternate)</div><div>--</div><div>--</div><div>X</div><div>X</div></div></div></div></div></div></div><div><div><div><div><div><div><div><div><div></div><div>Speed setting is used by P158</div></div></div><div><div><div><div><div>13D available on 15HP (11kW) &amp; higher drives.</div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div></div> |



| Code         |                           | Possible Settings |                                             | IMPORTANT                                                                                                      |
|--------------|---------------------------|-------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| No.          | Name                      | Default           | Selection                                   |                                                                                                                |
| <b>P 140</b> | Relay Output<br>TB-16, 17 | 0                 | 0 None                                      | Disables the output                                                                                            |
|              |                           |                   | 1 Run                                       | Energizes when the drive is running                                                                            |
|              |                           |                   | 2 Reverse                                   | Energizes when reverse rotation is active                                                                      |
|              |                           |                   | 3 Fault                                     | De-energizes when the drive trips, or power is removed                                                         |
|              |                           |                   | 4 Inverse Fault                             | Energizes when the drive trips                                                                                 |
|              |                           |                   | 5 Fault Lockout                             | P110 = 3...6: De-energizes if all restart attempts fail                                                        |
|              |                           |                   | 6 At Speed                                  | Energizes when output frequency = commanded frequency                                                          |
|              |                           |                   | 7 Above Preset Speed #6                     | Energizes when output frequency > P136                                                                         |
|              |                           |                   | 8 Current Limit                             | Energizes when motor current = P171                                                                            |
|              |                           |                   | 9 Follower Loss (4-20 mA)                   | Energizes when 4-20 mA signal is < P164                                                                        |
|              |                           |                   | 10 Loss of Load                             | Energizes when motor load drops below P145; Refer to P146 also                                                 |
|              |                           |                   | 11 Local Keypad Control Active              |                                                                                                                |
|              |                           |                   | 12 Terminal Strip Control Active            | Energizes when the selected source is active for start control                                                 |
|              |                           |                   | 13 Remote Keypad Control Active             |                                                                                                                |
|              |                           |                   | 14 Network Control Active                   |                                                                                                                |
|              |                           |                   | 15 Standard Reference Active                | Energizes when P101 reference is active                                                                        |
|              |                           |                   | 16 Auto Reference Active                    | Energizes when Auto Reference is activated using TB-13 input; refer to P121...P124                             |
|              |                           |                   | 17 Sleep Mode Active                        | Refer to P240...P242                                                                                           |
|              |                           |                   | 18 PID Feedback < Min. Alarm                | Energizes when PID feedback signal < P214                                                                      |
|              |                           |                   | 19 Inverse PID Feedback < Min. Alarm        | De-energizes when PID feedback signal < P214                                                                   |
|              |                           |                   | 20 PID Feedback > Max Alarm                 | Energizes when PID feedback signal > P215                                                                      |
|              |                           |                   | 21 Inverse PID Feedback > Max Alarm         | De-energizes when PID feedback signal > P215                                                                   |
|              |                           |                   | 22 PID Feedback within Min/Max Alarm range  | Energizes when PID feedback signal is within the Min/Max Alarm range; refer to P214, P215                      |
|              |                           |                   | 23 PID Feedback outside Min/Max Alarm range | Energizes when PID feedback signal is outside the Min/Max Alarm range; refer to P214, P215                     |
|              |                           |                   | 24 Reserved                                 |                                                                                                                |
|              |                           |                   | 25 Network Controlled                       | SMV models < 15HP (11kW) require an optional communication module (refer to the network module documentation). |
|              |                           |                   | 26 Loss of 0-10V Input                      | Energizes when 0-10V signal is < P158                                                                          |
|              |                           |                   | 27 Sequencer Controlled                     | State set in individual sequencer segments                                                                     |
|              |                           |                   | 28 Sequencer Active                         |                                                                                                                |
|              |                           |                   | 29 Sequencer Suspended                      |                                                                                                                |
|              |                           |                   | 30 Sequence Done                            | End Sequence                                                                                                   |
|              |                           |                   | 31 Output Frequency = 0.0Hz                 | Output inactive                                                                                                |
| <b>P 142</b> | TB-14 Output              | 0                 | 0...23 (same as P140)                       |                                                                                                                |
|              |                           |                   | 24 Dynamic Braking                          | For use with Dynamic Braking option                                                                            |
|              |                           |                   | 25...31 (same as P140)                      |                                                                                                                |



# Commissioning

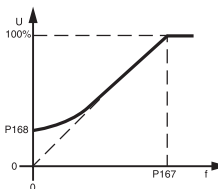
| Code  |                                                                                                                                                           | Possible Settings |                                                                                                                                                                                                                                                                     |                    |                    | IMPORTANT                                                                                                      |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|--------------------|----------------------------------------------------------------------------------------------------------------|--------------------------------------------|--------------------|-------------|----|----|----|----|-----|-----|-----|-----|----|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.   | Name                                                                                                                                                      | Default           | Selection                                                                                                                                                                                                                                                           |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 144 | Digital Output Inversion                                                                                                                                  |                   | <table><tr><td>P144</td><td>Invert P142</td><td>Invert P140</td></tr><tr><td>0</td><td>NO</td><td>NO</td></tr><tr><td>1</td><td>NO</td><td>YES</td></tr><tr><td>2</td><td>YES</td><td>NO</td></tr><tr><td>3</td><td>YES</td><td>YES</td></tr></table>               |                    |                    |                                                                                                                | P144                                       | Invert P142        | Invert P140 | 0  | NO | NO | 1  | NO  | YES | 2   | YES | NO | 3   | YES | YES                                                                                                                                                                                                                                                                                                                                     |
|       |                                                                                                                                                           |                   | P144                                                                                                                                                                                                                                                                | Invert P142        | Invert P140        |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 0                                                                                                                                                                                                                                                                   | NO                 | NO                 |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 1                                                                                                                                                                                                                                                                   | NO                 | YES                |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| 2     | YES                                                                                                                                                       | NO                |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| 3     | YES                                                                                                                                                       | YES               |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       | <b>NOTE</b><br>Inverting P140 or P142 when the parameter is set to NONE (0) will result in the output being energized continuously.                       |                   |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       | <b>NOTE</b><br>For SMVector drives rated at 0.33 to 10 HP (0.25 to 7.5 kW), P144 is only available with software versions 3.0 and higher (refer to P501). |                   |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 145 | Loss of Load Threshold                                                                                                                                    | 0                 | 0                                                                                                                                                                                                                                                                   | {%}                | 200                | P140, P142 = 10: Output will energize if motor load falls below the P145 value longer than the P146 time       |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 146 | Loss of Load Delay                                                                                                                                        | 0.0               | 0.0                                                                                                                                                                                                                                                                 | {s}                | 240.0              |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 149 | Analog Output Offset                                                                                                                                      | 0.0               | 0                                                                                                                                                                                                                                                                   | {%}                | 100                | Scaled value. Example: P149 = 10%, Scaled variable = freq, P150 = 1, P152 = 60Hz; then TB30 = 0VDC below 6Hz   |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 150 | TB-30 Output                                                                                                                                              | 0                 | 0 None                                                                                                                                                                                                                                                              |                    |                    | 2-10 VDC signal can be converted to 4-20 mA with a total circuit impedance of 500 Ω                            |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 1 0-10 VDC Output Frequency                                                                                                                                                                                                                                         |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 2 2-10 VDC Output Frequency                                                                                                                                                                                                                                         |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 3 0-10 VDC Load                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 4 2-10 VDC Load                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 5 0-10 VDC Torque                                                                                                                                                                                                                                                   |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 6 2-10 VDC Torque                                                                                                                                                                                                                                                   |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 7 0-10 VDC Power (kW)                                                                                                                                                                                                                                               |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 8 2-10 VDC Power (kW)                                                                                                                                                                                                                                               |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 9 Network Controlled                                                                                                                                                                                                                                                |                    |                    | SMV models < 15HP (11kW) require an optional communication module (refer to the network module documentation). |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 10 Sequencer Controlled                                                                                                                                                                                                                                             |                    |                    |                                                                                                                | Value set in individual sequencer segments |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 151 | Add Analog Input to TB-30 Output                                                                                                                          | 0                 | <table><tr><td>P151</td><td>Add TB-25 (4-20mA)</td><td>Add TB-5 (0-10VDC)</td></tr><tr><td>0</td><td>NO</td><td>NO</td></tr><tr><td>1</td><td>NO</td><td>YES</td></tr><tr><td>2</td><td>YES</td><td>NO</td></tr><tr><td>3</td><td>YES</td><td>YES</td></tr></table> |                    |                    | P151                                                                                                           | Add TB-25 (4-20mA)                         | Add TB-5 (0-10VDC) | 0           | NO | NO | 1  | NO | YES | 2   | YES | NO  | 3  | YES | YES | This parameter adds the analog input signal(s) to the TB-30 Output signal. EXAMPLE: If a drive is running at 60Hz with P150 set to 1 (0-10VDC Freq) and P152 set to 240.0Hz, the output at TB-30 would be 2.5VDC. If there is a 2.0VDC signal going into TB-5 and P151 is set to 1 (ADD TB-5), the output at TB-30 would become 4.5VDC. |
|       |                                                                                                                                                           |                   | P151                                                                                                                                                                                                                                                                | Add TB-25 (4-20mA) | Add TB-5 (0-10VDC) |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 0                                                                                                                                                                                                                                                                   | NO                 | NO                 |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 1                                                                                                                                                                                                                                                                   | NO                 | YES                |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   | 2                                                                                                                                                                                                                                                                   | YES                | NO                 |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| 3     | YES                                                                                                                                                       | YES               |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
|       |                                                                                                                                                           |                   |                                                                                                                                                                                                                                                                     |                    |                    |                                                                                                                |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 152 | TB-30 Scaling: Frequency                                                                                                                                  | 60.0              | 3.0                                                                                                                                                                                                                                                                 | {Hz}               | 2000               | If P150 = 1 or 2, sets the frequency at which output equals 10 VDC                                             |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 153 | TB-30 Scaling: Load                                                                                                                                       | 200               | 10                                                                                                                                                                                                                                                                  | {%}                | 500                | If P150 = 3 or 4, sets the Load (as a percent of drive current rating) at which output equals 10 VDC.          |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 154 | TB-30 Scaling: Torque                                                                                                                                     | 100               | 10                                                                                                                                                                                                                                                                  | {%}                | 1000               | If P150 = 5 or 6, sets the Torque (as a percent of motor rated torque) at which output equals 10 VDC           |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |
| P 155 | TB-30 Scaling: Power (kW)                                                                                                                                 | 1.0               | 0.1                                                                                                                                                                                                                                                                 | {kW}               | 200.0              | If P150 = 7 or 8, sets the power at which output equals 10 VDC                                                 |                                            |                    |             |    |    |    |    |     |     |     |     |    |     |     |                                                                                                                                                                                                                                                                                                                                         |

## 4.5.3 Advanced Setup Parameters

| Code  |                                                | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                   |            | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-------|------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.   | Name                                           | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                         |            |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| P 156 | Analog Inputs Configuration                    | 0                 | 0 TB5: (0-10 VDC); TB25: (4-20mA)<br>1 TB5: (0 - 5 VDC); TB25: (4-20mA)<br>2 TB5: (2 - 10 VDC); TB25: (4-20mA)<br>4 TB5: (0-10 VDC); TB25: (0-20mA)<br>5 TB5: (0 - 5 VDC); TB25: (0-20mA)<br>6 TB5: (2 - 10 VDC); TB25: (0-20mA)                                                                                                                                                  |            |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| P 157 | TB5 (0-10V) Analog Input Monitoring Action     | 0                 | 0 No Action<br>1 If TB5 < P158 - Trip Fault $F_{\_}FAU$<br>2 If TB5 < P158 - Run Preset #8<br>3 If TB5 < P158 - Run Preset Seg. #16<br>4 If TB5 > P158 - Trip Fault $F_{\_}FAU$<br>5 If TB5 > P158 - Run Preset #8<br>6 If TB5 > P158 - Run Preset Seg. #16                                                                                                                       |            | <p>Selects the reaction to a loss of the 0-10V signal at TB5</p> <p>500ms is the minimum time above/below Monitoring Level (P158) before triggering the drive to trip or run at a preset speed.</p> <p>For P157 = 3 or 6, the accel/decel time is set in P786.</p> <p><b>NOTE:</b> P157 has priority over P163 and TB-13 presets/auto references (P121-P124)</p>                                                                         |
| P 158 | TB5 (0-10V) Analog Input Monitoring Level (ML) | 0.0               | -10.0                                                                                                                                                                                                                                                                                                                                                                             | {VDC} 10.0 | Negative input voltage is not currently supported.                                                                                                                                                                                                                                                                                                                                                                                       |
| P 159 | 0-10V Analog Input Deadband                    | 0.0               | 0                                                                                                                                                                                                                                                                                                                                                                                 | {VDC} 10.0 | Not active if [-10 to +10 VDC] option is selected.                                                                                                                                                                                                                                                                                                                                                                                       |
| P 160 | Speed at Minimum Signal                        | 0.0               | -999.0                                                                                                                                                                                                                                                                                                                                                                            | {Hz} 1000  | <p>V0111</p>                                                                                                                                                                                                                                                                                                                                                                                                                             |
| P 161 | Speed at Maximum Signal                        | 60.0              | -999.0                                                                                                                                                                                                                                                                                                                                                                            | {Hz} 1000  |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|       |                                                |                   | <div></div> <p><b>NOTE</b></p> <ul style="list-style-type: none"><li>• P160 sets the output frequency at 0% analog input</li><li>• P161 sets the output frequency at 100% analog input</li><li>• P160 or P161 &lt; 0.0 Hz: For scaling purposes only; does not indicate opposite direction!</li><li>• P160 &gt; P161: Drive will react inversely to analog input signal</li></ul> |            |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| P 162 | Analog Input Filter                            | 0.01              | 0.00                                                                                                                                                                                                                                                                                                                                                                              | {s} 10.00  | <ul style="list-style-type: none"><li>• Adjusts the filter on the analog inputs (TB-5 and TB-25) to reduce the effect of signal noise</li><li>• The P162 delay time will affect the response time of diagnostic parameters (P520-P523).</li></ul>                                                                                                                                                                                        |
| P 163 | TB-25 (4-20mA) Analog Input Monitoring Action  | 0                 | 0 No Action<br>1 If TB25 < P164 - Trip Fault $F_{\_}FaL$<br>2 If TB25 < P164 - Run Preset #7<br>3 If TB25 < P164 - Run Preset Seg. #15<br>4 If TB25 ≥ P164 - Trip Fault $F_{\_}FaL$<br>5 If TB25 ≥ P164 - Run Preset #7<br>6 If TB25 ≥ P164 - Run Preset Seg. #15                                                                                                                 |            | <ul style="list-style-type: none"><li>• Selects the reaction to a loss of the 4-20 mA signal at TB-25.</li><li>• Signal is considered lost if it falls below the value set in P164</li><li>• Digital outputs can also indicate a loss of 4-20 mA signal; see P140, P142</li><li>• For P163 = 3 or 6, the accel/decel time is set in P781.</li></ul> <p><b>NOTE:</b> P163 has priority over TB-13 presets/auto references (P121-P124)</p> |



# Commissioning

| Code                 |                                              | Possible Settings                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                      |      |       | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                  | Name                                         | Default                                                                                                                                                                                                                                                                                | Selection                                                                                                                                                                                                            |      |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| P 164                | TB-25 (4-20mA) Analog Input Monitoring Level | 2.0                                                                                                                                                                                                                                                                                    | 0.0                                                                                                                                                                                                                  | {mA} | 20.0  | <div>Valid for V/Hz mode only.<br/>Set voltage for bus compensation in V/Hz mode</div> <ul style="list-style-type: none"><li>As carrier frequency is increased, motor noise is decreased</li><li>Observe derating in section 2.3</li><li>Automatic shift to 4 kHz at 120% load</li><li>NEMA 4X (IP65) Models: Default = 0 (4kHz)</li><li>NEMA 1 (IP31) Models: Default = 1 (6kHz)</li></ul> <div></div> <div>V0112</div> |
| P 165                | Base Voltage                                 |                                                                                                                                                                                                                                                                                        | 15                                                                                                                                                                                                                   | {V}  | 1000  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| P 166                | Carrier Frequency                            | See Notes                                                                                                                                                                                                                                                                              | 0 4 kHz<br>1 6 kHz<br>2 8 kHz<br>3 10 kHz                                                                                                                                                                            |      |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| P 167 <sup>(1)</sup> | Base Frequency                               | 60.0                                                                                                                                                                                                                                                                                   | 10.0                                                                                                                                                                                                                 | {Hz} | 1500  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| P 168                | Fixed Boost                                  |                                                                                                                                                                                                                                                                                        | 0.0                                                                                                                                                                                                                  | {%}  | 40.0  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                      |                                              | <div></div> <div><b>NOTE</b><ul style="list-style-type: none"><li>P167 = rated motor frequency for standard applications</li><li>P165, P168 = default setting depends on drive rating</li></ul></div> |                                                                                                                                                                                                                      |      |       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| P 169                | Accel Boost                                  | 0.0                                                                                                                                                                                                                                                                                    | 0.0                                                                                                                                                                                                                  | {%}  | 20.0  | Accel Boost is only active during acceleration                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P 170                | Slip Compensation                            | 0.0                                                                                                                                                                                                                                                                                    | 0.0                                                                                                                                                                                                                  | {%}  | 40.0  | Increase P170 until the motor speed no longer changes between no load and full load conditions.                                                                                                                                                                                                                                                                                                                                                                                                           |
| P 171 <sup>(1)</sup> | Current Limit                                | Max I                                                                                                                                                                                                                                                                                  | 30                                                                                                                                                                                                                   | {%}  | Max I | <ul style="list-style-type: none"><li>When the limit is reached, the drive displays <b>CL</b> (Current Limit), and either the acceleration time increases or the output frequency decreases.</li><li>Digital outputs can also indicate when the limit is reached; see P140, P142.</li><li>Refer to section 2.3 for the maximum output current Max I (%)</li></ul>                                                                                                                                         |
| P 172                | Current Limit Reduction                      | 0                                                                                                                                                                                                                                                                                      | 0 Current Limit Reduction Active - Normal response<br>1 Current Limit Reduction Active - Fast response<br>2 Current Limit Reduction Disabled - Normal response<br>3 Current Limit Reduction Disabled - Fast response |      |       | In field weakening, the Current Limit is inversely proportional to the speed.                                                                                                                                                                                                                                                                                                                                                                                                                             |
| P 173                | Decel Override Time                          | 2.0                                                                                                                                                                                                                                                                                    | 0.0                                                                                                                                                                                                                  | {s}  | 60.0  | Maximum time before drive trips into HF fault.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P 174                | DC Brake Voltage                             | 0.0                                                                                                                                                                                                                                                                                    | 0.0                                                                                                                                                                                                                  | {%}  | 50.0  | Setting is a percent of the nominal DC bus voltage.                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

(1) Any changes to this parameter will not take effect until the drive is stopped.

# Commissioning



| Code  |                                        | Possible Settings |                                                                                                                                                                             | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                  |
|-------|----------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.   | Name                                   | Default           | Selection                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| P 175 | DC Brake Time                          | 0.0               | 0.0 {s} 999.9                                                                                                                                                               | <b>NOTE:</b> CONFIRM MOTOR SUITABILITY FOR USE WITH DC BRAKING<br>DC Brake voltage (P174) is applied for the time specified by P175 with the following exceptions: <ul style="list-style-type: none"><li>• If P111=1, 3 and P175=999.9 the brake voltage will be applied continuously until a run or fault condition occurs.</li><li>• If P110=2, 4...6 and P175=999.9, brake voltage will be applied for 15s</li><li>• If P121...P124=18 and the corresponding TB-13 input is CLOSED, brake voltage will be applied until the TB-13 input is OPENED or a fault condition occurs.</li></ul> |                                                                                                                                                                                                                                                                  |
|       |                                        |                   |                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| P 176 | Keypad Setpoint Single Press Increment | 0.1               | 0.1 100.0                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Used for run screen setpoint editing only.<br>If P176 >0.1 then scrolling of keypad setpoint is enabled.                                                                                                                                                         |
| P 177 | Speed Units                            | 0                 | 0 Hz                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Select the UNITS LED that will be illuminated when the drive is running in speed control mode. For this parameter to be used, P178 must be set to a value other than 0. If P178 is set to 0, the Hz LED will be illuminated regardless of the value set in P177. |
|       |                                        |                   | 1 RPM                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
|       |                                        |                   | 2 %                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
|       |                                        |                   | 3 /UNITS                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
|       |                                        |                   | 4 NONE                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| P 178 | Display Frequency Multiplier           | 0.00              | 0.00 650.00                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"><li>• Allows frequency display to be scaled</li><li>• P178 = 0.00: Scaling disabled</li><li>• P178 &gt; 0.00: Display = Actual Frequency X P178</li></ul>                                                                      |
|       |                                        |                   | <b>EXAMPLE</b><br>If P178 = 29.17 and actual frequency = 60 Hz, then Drive displays 1750 (rpm)                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| P 179 | Run Screen Display                     | 0                 | 0 {Parameter Number} 599                                                                                                                                                    | <ul style="list-style-type: none"><li>• 0 = Normal Run Screen, this display depends on mode of operation. Refer to section 4.2.</li><li>• Other selections choose a diagnostic parameter to display (P501...P599).</li><li>• Parameters P560 - P564 are selectable if the sequencer is enabled (P700 is not 0). P560-P564 are not visible until P700 is enabled.</li></ul>                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                  |
| P 180 | Oscillation Damping Control            | 0                 | 0 80                                                                                                                                                                        | 0 = Damping disabled<br>Compensation for resonances within drive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                  |
| P 181 | Skip frequency 1                       | 0.0               | 0.0 {Hz} 500                                                                                                                                                                | <ul style="list-style-type: none"><li>• Drive will not run in the defined skip range; used to skip over frequencies that cause mechanical vibration</li><li>• P181 and P182 define the start of the skip ranges</li><li>• P184 &gt; 0 defines the bandwidth of both ranges.</li></ul>                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                  |
| P 182 | Skip frequency 2                       | 0.0               | 0.0 {Hz} 500                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| P 184 | Skip frequency bandwidth               | 0.0               | 0.0 {Hz} 10.0                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
|       |                                        |                   | <b>NOTE</b><br>Bandwidth (Hz) = f <sub>1</sub> (Hz) + P184 (Hz)      f <sub>s</sub> = P181 or P182<br>EXAMPLE: P181 = 18 Hz and P184 = 4 Hz; skip range is from 18 to 22 Hz |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
| P 185 | Voltage Midpoint V/Hz characteristic   | 0                 | 0.0 {V} P165                                                                                                                                                                | Valid only when P300 = 0 or 2.<br>Use with P187 to define midpoint on V/Hz curve.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                  |
| P 187 | Frequency Midpoint V/Hz characteristic | 0.0               | 0.0 {Hz} P167                                                                                                                                                               | Valid only when P300 = 0 or 2.<br>Use with P185 to define midpoint on V/Hz curve.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                  |
| P 189 | Integrated Dynamic Brake               | 0                 | Disabled                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |
|       |                                        | 1                 | Enabled                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                  |

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

(3) Parameter applicable to SMV models 40HP (30kW) and higher.



# Commissioning

| Code  |                                            | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------|--------------------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.   | Name                                       | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| P 190 | Motor Braking                              |                   | 0 Disabled                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Flux brake OFF.                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | 1 Braking with BUS threshold                                                                                                                                                                                                                                                                                                                                                                                                                                     | When drive is in deceleration and $V_{bus} > V_{deceleration\ freeze}$ (114% of the rated $V_{bus}$ ), the flux brake will be turned ON.                                                                                                                                                                                                                                                                                                                                               |
|       |                                            |                   | 2 Braking always on with deceleration                                                                                                                                                                                                                                                                                                                                                                                                                            | As long as drive is in deceleration, the flux brake will be ON.                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | 3 Braking with bus regulator                                                                                                                                                                                                                                                                                                                                                                                                                                     | When drive is in deceleration and $V_{bus} > V_{deceleration\ freeze}$ (114% of the rated $V_{bus}$ ), the motor speed will be increased to reduce the bus voltage. Determined by the value in P191, the speed increment = slip speed * P191(%) / 37.                                                                                                                                                                                                                                  |
|       |                                            |                   | 4 Special                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (Consult factory before using)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|       |                                            |                   | <b>WARNING</b><br>Flux braking can cause heat in the motor. To avoid damage to the motor, use a PTC to protect the motor. If the flux brake is used too frequently, the drive will trip fault "F_PF".                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| P 191 | Motor Brake Level                          | 0                 | 0 { } 75<br>(flux braking disabled)                                                                                                                                                                                                                                                                                                                                                                                                                              | Active when P190 > 0 and drive is in deceleration mode. Use to reduce deceleration time on high inertia loads.<br><b>NOTE:</b> Over usage of P190 can cause frequent 'overload' trips "F,PF"<br>Not active for P300 = 5 (Torque mode)                                                                                                                                                                                                                                                  |
| P 192 | Motor Braking Deceleration Reduction Level | 0.0               | 0 P167 (base freq)<br><br>Raising the value of P191 reduces the drive deceleration rate during flux braking.                                                                                                                                                                                                                                                                                                                                                     | Active when P190 > 0 and P192 > 0.0. Drive is in deceleration mode. Use to reduce deceleration time on high inertia loads.<br><b>NOTE:</b> Usage of P192 can cause the drive to decelerate faster than settings in P105/P127.<br>Not active for P300 = 5 (Torque mode)                                                                                                                                                                                                                 |
| P 194 | Password                                   | 0                 | 0000 9999                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"> <li>Must enter password to access parameters</li> <li>P194 = 0000: Disables password</li> </ul>                                                                                                                                                                                                                                                                                                                                                     |
| P 197 | Clear Fault History                        | 0                 | 0 No Action<br>1 Clear Fault History                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| P 199 | Program Selection                          |                   | 0 Operate from User settings                                                                                                                                                                                                                                                                                                                                                                                                                                     | Refer to Notes 1, 2 and 3<br><br>Refer to Note 1<br><br><ul style="list-style-type: none"> <li>Refer to Note 4</li> <li>Parameters are reset to the defaults listed in this manual.</li> <li>For P199=4, the following exceptions apply:               <ul style="list-style-type: none"> <li>P103, P152, P161, P167 = 50.0 Hz</li> <li>P165 = 400V (400/480V drives only)</li> <li>P304 = 50 Hz</li> <li>P305 = 1450 RPM</li> <li>P107 = 0 (480 V drives only)</li> </ul> </li> </ul> |
|       |                                            |                   | 1 Operate from OEM settings                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | 2 Reset to OEM default settings                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | 3 Reset to 60 Hz default settings                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | 4 Reset to 50 Hz default settings                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | 5 Translate                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Refer to Note 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | <b>WARNING!</b><br>Modification of P199 can affect drive functionality! STOP and EXTERNAL FAULT circuitry may be disabled! Check P100 and P121...P124                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|       |                                            |                   | <b>NOTE 1</b><br>If the EPM does not contain valid OEM settings, a flashing GF will be displayed when P199 is set to 1 or 2.<br><br><b>NOTE 2</b><br>When P199 is set to 1, the drive operates from the OEM settings stored in the EPM Module and no other parameters can be changed (GF will be displayed if attempted).<br><br><b>NOTE 3</b><br>Auto Calibration is not possible when operating from OEM Settings.<br><br><b>NOTES 4 and 5 - on next page.</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |





| Code |                   | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | IMPORTANT |
|------|-------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| No.  | Name              | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |           |
| P199 | Program Selection |                   | <p><b>NOTE 4</b><br/>Resetting to 50 and 60 Hz default settings will set the Assertion Level (P120) to "2" (High). P120 may need to be reset for the digital input devices being used. An <b>F<sub>AL</sub></b> fault may occur if P120 and the Assertion switch are not set identically.</p> <p><b>NOTE 5</b><br/>If an EPM that contains data from a previous compatible software version is installed:</p> <ul style="list-style-type: none"> <li>The drive will operate according to the previous data, but parameters cannot be changed (<b>cE</b> will be displayed if attempted)</li> <li>To update the EPM to the current software version, set P199 = 5. The parameters can now be changed but the EPM is incompatible with previous software revisions.</li> </ul> |           |

## 4.5.4 PID Parameters

| Code |                            | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | IMPORTANT                                                                                                                                                                                                                                                                                                                                                    |
|------|----------------------------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.  | Name                       | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                              |
| P200 | PID Mode                   | 0                 | 0 Disabled<br>1 Normal-acting<br>2 Reverse-acting<br>3 Normal-acting, Bi-directional<br>4 Reverse-acting, Bi-directional                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Normal-acting: As feedback increases, motor speed decreases</li> <li>Reverse-acting: As feedback increases, motor speed increases</li> <li>PID mode is disabled in Vector Torque mode (P300 = 5)</li> <li>Selections 3, 4: If P112=1, PID controller output sets the speed, (range -max freq to +max freq)</li> </ul> |
|      |                            |                   | <p><b>NOTE</b><br/>To activate PID mode, one of the TB-13 inputs (P121...P124) must be used to select the Auto Reference that matches the desired PID setpoint reference. If the selected PID setpoint reference uses the same analog signal as the PID feedback (P201), an <b>F<sub>AL</sub></b> fault will occur.<br/> <b>Example:</b> The desired PID setpoint reference is the keypad (<b>▲</b> and <b>▼</b>). Set TB-13x = 6 (Auto Reference: Keypad):</p> <ul style="list-style-type: none"> <li>TB-13x = closed: PID mode is active</li> <li>TB-13x = open: PID mode is disabled and the drive speed will be controlled by the reference selected in P101.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                              |
| P201 | PID Feedback Source        | 0                 | 0 4-20 mA (TB-25)<br>1 0-10 VDC (TB-5)<br>2 Drive Load (P507)<br>3 Feedback from Network                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Must be set to match the PID feedback signal                                                                                                                                                                                                                                                                                                                 |
| P202 | PID Decimal Point          | 1                 | 0 PID Display = XXXX<br>1 PID Display = XXX.X<br>2 PID Display = XX.XX<br>3 PID Display = X.XXX<br>4 PID Display = .XXXX                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Applies to P204, P205, P214, P215, P231...P233, P242, P522, P523                                                                                                                                                                                                                                                                                             |
| P203 | PID Units                  | 0                 | 0 %<br>1 /UNITS<br>2 AMPS<br>3 NONE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Select the UNITS LED that will be illuminated when the drive is running in PID control mode                                                                                                                                                                                                                                                                  |
| P204 | Feedback at Minimum Signal | 0.0               | -99.9 3100.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Set to match the range of the feedback signal being used                                                                                                                                                                                                                                                                                                     |
| P205 | Feedback at Maximum Signal | 100.0             | -99.9 3100.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Example:</b> Feedback signal is 0 - 300 PSI; P204 = 0.0, P205 = 300.0                                                                                                                                                                                                                                                                                     |

(2) Parameter applicable to SMV models 15HP (11kW) and higher.

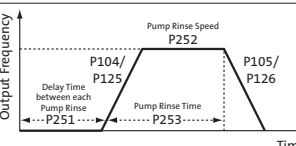


# Commissioning

| Code |                                        | Possible Settings |                                                                                                                                                                                                                                 |      |                  | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------|----------------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.  | Name                                   | Default           | Selection                                                                                                                                                                                                                       |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P207 | Proportional Gain                      | 5.0               | 0.0                                                                                                                                                                                                                             | {%}  | 1000.0           | Used to tune the PID loop: <ul style="list-style-type: none"><li>• Increase P207 until system becomes unstable, then decrease P207 by 10-15%</li><li>• Next, increase P208 until feedback matches setpoint</li><li>• If required, increase P209 to compensate for sudden changes in feedback</li></ul>                                                                                                                                                            |
| P208 | Integral Gain                          | 0.0               | 0.0                                                                                                                                                                                                                             | {s}  | 20.0             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P209 | Derivative Gain                        | 0.0               | 0.0                                                                                                                                                                                                                             | {s}  | 20.0             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|      |                                        |                   | <b>NOTE</b> <ul style="list-style-type: none"><li>• Derivative Gain is very sensitive to noise on the feedback signal. Use with care.</li><li>• Derivative Gain is not normally required in pump and fan applications</li></ul> |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P210 | PID Setpoint Ramp                      | 20.0              | 0.0                                                                                                                                                                                                                             | {s}  | 100.0            | <ul style="list-style-type: none"><li>• time of setpoint change from P204 to P205 or vice versa.</li><li>• Used to smooth the transition from one PID setpoint to another, such as when using the Preset PID Setpoints (P231...P233)</li></ul>                                                                                                                                                                                                                    |
| P214 | Minimum Alarm                          | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | Use with P140, P142 = 18...23                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| P215 | Maximum Alarm                          | 0.0               | P204                                                                                                                                                                                                                            |      | P205             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P231 | Preset PID Setpoint #1                 | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | TB-13A activated; P121 = 3 and P200 = 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                      |
| P232 | Preset PID Setpoint #2                 | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | TB-13B activated; P122 = 3 and P200 = 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                      |
| P233 | Preset PID Setpoint #3                 | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | TB-13C activated; P123 = 3 and P200 = 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                      |
| P234 | Preset PID Setpoint #4                 | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | TB-13D activated; P124 = 3 and P200 = 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                      |
| P240 | Sleep Threshold                        | 0.0               | 0.0                                                                                                                                                                                                                             | {Hz} | 500.0            | <ul style="list-style-type: none"><li>• If drive speed &lt; P240 for longer than P241, output frequency = 0.0 Hz; drive display = <b>SLP</b></li><li>• P240 = 0.0: Sleep mode is disabled.</li><li>• P200 = 0...2: Drive will start again when speed command is above P240</li><li>• P242 &gt; 0.0: Drive will restart when the PID feedback differs from the setpoint by more than the value of P242 or when the PID loop requires a speed above P240.</li></ul> |
| P241 | Sleep Delay                            | 30.0              | 0.0                                                                                                                                                                                                                             | {s}  | 300.0            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P242 | Sleep Bandwidth                        | 0.0               | 0.0                                                                                                                                                                                                                             |      | B <sub>max</sub> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|      |                                        |                   | Where: B <sub>max</sub> = I(P205 - P204)                                                                                                                                                                                        |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P243 | Feedback Sleep Entry Threshold         | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | Active only when P244 = 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P244 | Sleep Entry Mode                       | 0                 | 0 Enter SLEEP if Drive Speed <P240<br>1 Enter SLEEP if Feedback >P243<br>2 Enter SLEEP if Feedback <P243                                                                                                                        |      |                  | For time longer than P241<br>For time longer than P241 or same as Sel 0<br>For time longer than P241 or same as Sel 0                                                                                                                                                                                                                                                                                                                                             |
| P245 | Sleep Entry Stop Type                  | 0                 | 0 Coast to Stop<br>1 Ramp to Stop<br>2 Stop with P111 settings                                                                                                                                                                  |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| P246 | Feedback Recovery from Sleep Threshold | 0.0               | P204                                                                                                                                                                                                                            |      | P205             | Active only when P247 = 1 or 2                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P247 | Sleep Recovery Mode                    | 0                 | 0 Recovery if Speed Setpoint > P240 or if PID feedback differs from setpoint by more than P242<br>1 Recovery only if Feedback < P246<br>2 Recovery only if Feedback > P246                                                      |      |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



| Code |                                      | Possible Settings |                                                                                                                                                          |        | IMPORTANT                                                                         |
|------|--------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----------------------------------------------------------------------------------|
| No.  | Name                                 | Default           | Selection                                                                                                                                                |        |                                                                                   |
| P250 | Auto Rinse in Sleep Mode             | 0                 | 0 Disabled<br>1 Enabled                                                                                                                                  |        | Activated in sleep mode only.<br>Sleep Recovery cancels Auto Rinse                |
| P251 | Time Delay between Auto Rinses       | 30.0              | 0.0 {min}                                                                                                                                                | 6553.5 | Time delay reset by re/entering sleep mode                                        |
| P252 | Auto Rinse Speed                     | 0.0               | -500.0 {Hz}                                                                                                                                              | 500.0  | If P112 = 1, negative sign = reverse direction                                    |
| P253 | Auto Rinse Time                      | 0.0               | 0.0 {sec}                                                                                                                                                | 6553.5 | Does not include time to decel back to speed                                      |
|      |                                      |                   | Auto Pump Rinse Setup:<br>P250=1 (Enabled)<br>P251=# minutes between each PumpRinse<br>P252=Hz speed of Pump Rinse<br>P253=# seconds Pump Rinse duration |        |  |
| P280 | Current Level: Flying Restart Type 2 | 70.0              | 0.0 { % }                                                                                                                                                | P171   | Maximum current during Type 2 flying restart operation                            |
| P281 | Decel Time: Flying Restart Type 2    | 3.0               | 0.0 {sec}                                                                                                                                                | 3600.0 | Deceleration rate used during Type 2 flying restart operation                     |

## 4.5.5 Vector Parameters

| Code                |                     | Possible Settings |                                                                                    | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------|---------------------|-------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                 | Name                | Default           | Selection                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| P300 <sup>(1)</sup> | Drive Mode          | 0                 | 0 Constant V/Hz                                                                    | Constant torque V/Hz control for general applications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                     |                     |                   | 1 Variable V/Hz                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                     |                     |                   | 2 Enhanced Constant V/Hz                                                           | For single or multiple motor applications that require better performance than settings 0 or 1, but cannot use Vector mode, due to: <ul style="list-style-type: none"><li>• Missing required motor data</li><li>• Vector mode causing unstable motor operation</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                     |                   | 3 Enhanced Variable V/Hz                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                     |                     |                   | 4 Vector Speed                                                                     | For single-motor applications requiring higher starting torque and speed regulation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                     |                     |                   | 5 Vector Torque                                                                    | For single-motor applications requiring torque control independent of speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                     |                     |                   |  | <b>NOTE</b><br>To configure the drive for either Vector mode or Enhanced V/Hz mode: <ul style="list-style-type: none"><li>• P300 = 4, 5:<ul style="list-style-type: none"><li>- Set P302...P306 according to motor nameplate</li><li>- Set P399 = 1 or 2 (if option 1 failed or in case of non-standard motor)</li><li>- Make sure motor is cold (20° - 25° C) and apply a Start command</li><li>- Display will indicate <b>CAL</b> for about 40 seconds</li><li>- Once the calibration is complete, the display will indicate <b>Stop</b>; apply another Start command to actually start the motor</li><li>- If an attempt is made to start the drive in Vector or Enhanced V/Hz mode before performing the Motor Calibration, the drive will display <b>F_n Id</b> and will not operate</li></ul></li><li>• P300 = 2, 3: Same as above but only need to set P302...P304</li></ul> |
| P302 <sup>(1)</sup> | Motor Rated Voltage |                   | 0 {V} 600                                                                          | <ul style="list-style-type: none"><li>• Default setting = drive rating</li><li>• Set to motor nameplate data</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| P303 <sup>(1)</sup> | Motor Rated Current |                   | 0.1 {A} 500.0                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

(1) Any changes to this parameter will not take effect until the drive is stopped.



# Commissioning

| Code                |                                   | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             | IMPORTANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------|-----------------------------------|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                 | Name                              | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P304 <sup>(1)</sup> | Motor Rated Frequency             | 60                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {Hz} 1000   | Set to motor nameplate data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| P305 <sup>(1)</sup> | Motor Rated Speed                 | 1750              | 300                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | {RPM} 65000 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P306 <sup>(1)</sup> | Motor Cosine Phi                  | 0.80              | 0.40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.99        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                                   |                   | <b>NOTE</b> If motor cosine phi is not known, use one of the following formulas:<br>cos phi = motor Watts / (motor efficiency X P302 X P303 X 1.732)<br>cos phi = cos [ sin <sup>-1</sup> (magnetizing current / motor current) ]                                                                                                                                                                                                                                                                                                                           |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P310 <sup>(1)</sup> | Motor Stator Resistance           |                   | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | {Ω} 64.00   | <ul style="list-style-type: none"><li>P310, 311 default setting depends on drive rating</li><li>Will be automatically programmed by P399</li><li>Changing these settings can adversely affect performance. Contact factory technical support prior to changing</li></ul>                                                                                                                                                                                                                                                   |
| P311 <sup>(1)</sup> | Motor Stator Inductance           |                   | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | {mH} 2000   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P315                | Dead Time Compensation Factor     | 0.0               | -50.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | {%} +50.0   | <ul style="list-style-type: none"><li>Adjust dead time correction from internal default</li><li>Takes effect when P399 = 3.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                      |
| P330                | Torque Limit                      | 100               | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {%} 400     | When P300 = 5, sets the maximum output torque.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| P331                | Preset Torque Setpoint #1         | 100               | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {%} 400     | TB-13A activated; P121 = 3 and P300 = 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P332                | Preset Torque Setpoint #2         | 100               | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {%} 400     | TB-13B activated; P122 = 3 and P300 = 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P333                | Preset Torque Setpoint #3         | 100               | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {%} 400     | TB-13C activated; P123 = 3 and P300 = 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P334 <sup>(2)</sup> | Preset Torque Setpoint #4         | 100               | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {%} 400     | TB-13D activated; P124 = 3 and P300 = 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| P340 <sup>(1)</sup> | Current Loop P Gain               | 0.25              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             | Changing these settings can adversely affect performance. Contact factory technical support prior to changing.                                                                                                                                                                                                                                                                                                                                                                                                             |
| P341 <sup>(1)</sup> | Current Loop I Gain               | 65                | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | {ms} 9990   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P342 <sup>(1)</sup> | Speed Loop Adjust                 | 0.0               | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | {%} 20.0    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| P343                | Slip Compensation Response Filter | 99                | 90                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | {ms} 9999   | Low pass filter time constant for varying the slip compensation response to changes in the motor current.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| P399                | Motor Auto-calibration            | 0                 | 0 Calibration Not Done                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             | <ul style="list-style-type: none"><li>If P300 = 4 or 5, motor calibration must be performed if P399 is not set to 3 (bypass calibration).</li><li>If P300=2 or 3, motor calibration is recommended.</li><li>Use option 2 if option 1 failed or in case of non-standard motors</li><li>An alternating <b>CAL</b> / <b>Err</b> will occur if:<ul style="list-style-type: none"><li>- attempt motor calibration with P300 = 0 or 1</li><li>- motor calibration is attempted before programming motor data</li></ul></li></ul> |
|                     |                                   |                   | 1 Standard Calibration Enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                                   |                   | 2 Advanced Calibration Enabled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                                   |                   | 3 Bypass Calibration, enable operation in vector mode w/o Auto Calibration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                                   |                   | 4 Standard Calibration Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                                   |                   | 5 Advanced Calibration Complete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                     |                                   |                   | <b>NOTE:</b> To run the Auto Calibration: <ul style="list-style-type: none"><li>Set P302...P306 according to motor nameplate</li><li>Set P399 = 1 or 2 (if option 1 failed or in case of non-standard motor)</li><li>Make sure motor is cold (20° - 25° C)</li><li>Apply a Start command</li><li>Display will indicate <b>CAL</b> for about 40 seconds</li><li>Once the calibration is complete, the display will indicate <b>Stop</b>; apply another Start command to actually start the motor</li><li>Parameter P399 will now be set to 4 or 5.</li></ul> |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

(1) Any changes to this parameter will not take effect until the drive is stopped.

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



## 4.5.6 Network Parameters

| Code                 |                            | Possible Settings |                                                                                                                                                                                                               | IMPORTANT                                                                                                                                                                          |
|----------------------|----------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                  | Name                       | Default           | Selection                                                                                                                                                                                                     |                                                                                                                                                                                    |
| <b>P400</b>          | Network Protocol           |                   | 0 Not Active<br>1 Remote Keypad<br>2 Modbus RTU<br>3 CANopen<br>4 DeviceNet<br>5 Ethernet<br>6 Profibus<br>7 Lecom-B<br>8 I/O Module                                                                          | This parameter setting is based upon the network or I/O module that is installed.                                                                                                  |
| <b>P401</b>          | Module Type Installed      | 0                 | 0 No Module Installed<br>1 Basic I/O (0x0100, 1.0.0)<br>2 RS485/Rem. Keypad (0x0200, 2.0.0)<br>3 CANopen (0x0300, 3.0.0)<br>11 PROFIBUS (0x1100, 11.0.0)<br>12 Ethernet (0x1200, 12.0.0)                      | Module type format: 0xAABC; Drive Display: AA.B.C<br>AA = Module Type<br>B = Major revision<br>C = minor revision                                                                  |
| <b>P402</b>          | Module Status              | 0                 | 0 Not Initialized<br>1 Initialization: Module to EPM<br>2 Initialization: EPM to Module<br>3 Online<br>4 Failed Initialization Error<br>5 Time-out Error<br>6 Initialization Failed<br>7 Initialization Error | Module type mismatch P401<br>Protocol selection mismatch P400                                                                                                                      |
| <b>P403</b>          | Module Reset               | 0                 | 0 No Action<br>1 Reset parameters to default values                                                                                                                                                           | Returns module parameters 401...499 to the default values shown in the manual                                                                                                      |
| <b>P404</b>          | Module Timeout Action      | 3                 | 0 No Fault<br>1 STOP (see P111)<br>2 Quick Stop<br>3 Fault (F <sub>ntF</sub> )                                                                                                                                | Action to be taken in the event of a Module/Drive Time-out.<br>Time is fixed at 200ms<br>STOP is by the method selected in P111.                                                   |
| <b>P405</b>          | Current Network Fault      |                   | 0 No Fault<br>1 F.nF1<br>2 F.nF2<br>3 F.nF3<br>4 F.nF4<br>5 F.nF5<br>6 F.nF6<br>7 F.nF7                                                                                                                       | Netidle Mode<br>Loss of Ethernet I/O connection<br>Network Fault<br>Explicit Message Timeout<br>Overall Network Timeout<br>Overall Explicit Timeout<br>Overall I/O Message Timeout |
| <b>P406</b>          | Proprietary                |                   |                                                                                                                                                                                                               | Manufacturer specific                                                                                                                                                              |
| <b>P407 ... P499</b> | Module Specific Parameters |                   |                                                                                                                                                                                                               | Refer to the Communications Reference Guide specific to the network or I/O module installed.                                                                                       |



# Commissioning

## 4.5.7 Diagnostic Parameters

| Code |                                | Display Range (READ ONLY) |               | IMPORTANT                                                                                                                                                                                                                                                            |
|------|--------------------------------|---------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.  | Name                           |                           |               |                                                                                                                                                                                                                                                                      |
| P500 | Fault History                  |                           |               | <ul style="list-style-type: none"> <li>Displays the last 8 faults</li> <li>Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the F.)</li> <li>Refer to section 5.3</li> </ul>                                                           |
| P501 | Software Version               |                           |               | Format: x.yz                                                                                                                                                                                                                                                         |
| P502 | Drive ID                       |                           |               | A flashing display indicates that the Drive ID stored in the EPM does not match the drive model it is plugged into.                                                                                                                                                  |
| P503 | Internal Code                  |                           |               | Alternating Display: xxx-; -yy                                                                                                                                                                                                                                       |
| P505 | DC Bus Voltage                 | 0                         | {VDC} 1500    |                                                                                                                                                                                                                                                                      |
| P506 | Motor Voltage                  | 0                         | {VAC} 1000    |                                                                                                                                                                                                                                                                      |
| P507 | Load                           | 0                         | {%} 255       | Motor load as % of drive's output current rating. Refer to section 2.3.                                                                                                                                                                                              |
| P508 | Motor Current                  | 0.0                       | {A} 1000      | Actual motor current                                                                                                                                                                                                                                                 |
| P509 | Torque                         | 0                         | {%} 500       | Torque as % of motor rated torque (vector mode only)                                                                                                                                                                                                                 |
| P510 | Output Power kW                | 0.00                      | {kW} 650.0    |                                                                                                                                                                                                                                                                      |
| P511 | Total kWh                      | 0.0                       | {kWh} 9999999 | Alternating display: xxx-; yyyy when value exceeds 9999                                                                                                                                                                                                              |
| P512 | Heatsink Temp                  | 0                         | {°C} 150      | Heatsink temperature                                                                                                                                                                                                                                                 |
| P520 | 0-10 VDC Input                 | 0.0                       | {VDC} 10.0    | Actual value of signal at TB-5 (See P162)                                                                                                                                                                                                                            |
| P521 | 4-20 mA Input                  | 0.0                       | {mA} 20.0     | Actual value of signal at TB-25 (See P162)                                                                                                                                                                                                                           |
| P522 | TB-5 Feedback                  | P204                      | P205          | TB-5 signal value scaled to PID feedback units (See P162)                                                                                                                                                                                                            |
| P523 | TB-25 Feedback                 | P204                      | P205          | TB-25 signal value scaled to PID feedback units (See P162)                                                                                                                                                                                                           |
| P524 | Network Feedback               | P204                      | P205          | Network signal value scaled to PID feedback units                                                                                                                                                                                                                    |
| P525 | Analog Output                  | 0                         | {VDC} 10.0    | Refer to P150...P155                                                                                                                                                                                                                                                 |
| P527 | Actual Output Frequency        | 0                         | {Hz} 500.0    |                                                                                                                                                                                                                                                                      |
| P528 | Network Speed Command          | 0                         | {Hz} 500.0    | Command speed if (Auto: Network) is selected as the speed source                                                                                                                                                                                                     |
| P530 | Terminal and Protection Status |                           |               | Indicates terminal status using segments of the LED display. (Refer to section 4.5.7.1)                                                                                                                                                                              |
| P531 | Keypad Status                  |                           |               | Indicates keypad button status using segments of the LED display. (Refer to section 4.5.7.2)                                                                                                                                                                         |
| P540 | Total Run Time                 | 0                         | {h} 9999999   | Alternating display: xxx-; yyyy when value exceeds 9999                                                                                                                                                                                                              |
| P541 | Total Power On Time            | 0                         | {h} 9999999   |                                                                                                                                                                                                                                                                      |
| P550 | Fault History                  | 1                         | 8             | <ul style="list-style-type: none"> <li>Displays the last 8 faults</li> <li>Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the F.)</li> <li>Refer to section 5.3</li> </ul>                                                           |
| P551 | Fault History Time             | 0                         | {h} 999999    | Display: "n.hh-" "hhhh" "mm.ss" = fault #, hours, seconds<br>The "hhhh" screen is displayed after hours exceed 999.                                                                                                                                                  |
| P552 | Fault History Counter          | 0                         | 255           | Number of sequential occurrences of a fault.<br>For example: 3 external faults occur over a period of time with no other errors occurring. Then P552 will indicate 3, P550 will indicate the error EF and P551 will indicate the time of the first fault occurrence. |

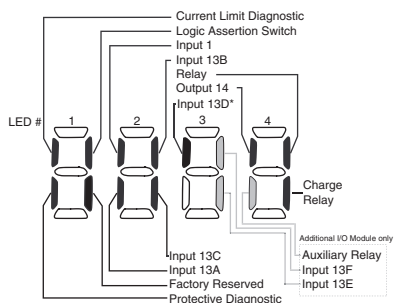
| Code        |                                               | Display Range (READ ONLY)                                                                        |                                     | IMPORTANT                                     |
|-------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------------------|-----------------------------------------------|
| No.         | Name                                          |                                                                                                  |                                     |                                               |
| <b>P560</b> | Sequencer: Currently Active Segment           | 0                                                                                                | 17                                  |                                               |
| <b>P561</b> | Sequencer: Time since Start of Active Segment | 0.0<br>0                                                                                         | {P708}<br>{P708}<br>6553.5<br>65535 | Unit depends on P708 (0.1sec, sec or minutes) |
| <b>P562</b> | Sequencer: Time Remaining in Active Segment   | 0.0<br>0                                                                                         | {P708}<br>{P708}<br>6553.5<br>65535 | Unit depends on P708 (0.1sec, sec or minutes) |
| <b>P563</b> | Sequencer: Number of cycles since start       | 0                                                                                                | 65535                               |                                               |
| <b>P564</b> | Sequencer: Number of cycles remaining         | 0                                                                                                | 65535                               |                                               |
|             |                                               | <b>NOTE:</b> Parameters P560-P564 are visible only when P700 > 0 (i.e. the sequencer is enabled) |                                     |                                               |

## 4.5.7.1 Terminal & Protection Status Display

Parameter P530 allows monitoring of the control terminal points and common drive conditions:

An illuminated LED segment indicates:

- the protective circuit is active (LED 1)
- the Logic Assertion Switch is set to High (+)
- input terminal is asserted (LED 2)
- output terminal is energized (LED 4)
- the Charge Relay is not a terminal, this segment will be illuminated when the Charge Relay is energized (LED 4).



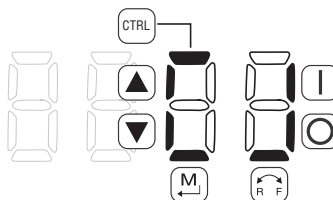
\* Input 13D available on 15-60HP (11-45kW) models only

## 4.5.7.2 Keypad Status Display

Parameter P531 allows monitoring of the keypad pushbuttons:

An illuminated LED segment indicates when the button is depressed.

LED 1 and LED 2 are used to indicate pushbutton presses on a remote keypad that is attached to the drive. LED 3 and LED 4 indicate button presses on the local drive keypad.





# Commissioning

## 4.5.8 Onboard Communications Parameters 15-60HP (11-45kW)

The P6xx Onboard Communication parameters are applicable to the 15HP (11kW) and higher models only.

| Code |                              | Possible Settings |                                                                                                                                                                                                   | IMPORTANT                                                                                                      |
|------|------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| No.  | Name                         | Default           | Selection                                                                                                                                                                                         |                                                                                                                |
| P600 | Network Enable               | 0                 | 0 Disabled<br>1 Remote Keypad<br>2 Modbus<br>7 Lecom                                                                                                                                              | This parameter enables the onboard network communications.                                                     |
|      |                              |                   | <b>NOTE:</b> Onboard Communications will be disabled if:<br>- P600 = 0, or<br>- P600 = 1 and P400 = 1, or<br>- P600 = 2 and P400 = 2, 3, 4, 5, 6 or 7<br>- P600 = 7 and P400 = 2, 3, 4, 5, 6 or 7 | If the onboard communications are disabled, the user will not have access to any of the other P6xx parameters. |
| P610 | Network Address              | 1                 | 1 - 247                                                                                                                                                                                           | Modbus                                                                                                         |
|      |                              | 1                 | 1 - 99                                                                                                                                                                                            | Lecom                                                                                                          |
| P611 | Network Baud Rate            | 2                 | 0 2400 bps      2 9600 bps<br>1 4800 bps      3 19200 bps                                                                                                                                         | Modbus                                                                                                         |
|      |                              | 0                 | 0 9600 bps<br>1 4800 bps<br>2 2400 bps<br>3 1200 bps<br>4 19200 bps                                                                                                                               | Lecom                                                                                                          |
| P612 | Network Data Format          | 0                 | 0 8, N, 2<br>1 8, N, 1<br>2 8, E, 1<br>3 8, O, 1                                                                                                                                                  | Modbus Only                                                                                                    |
| P620 | Network Control Level        | 0                 | 0 Monitor Only<br>1 Parameter Programming<br>2 Programming and Setpoint Control<br>3 Full Control                                                                                                 | Lecom Only                                                                                                     |
| P624 | Network Powerup Start Status | 0                 | 0 Quick Stop<br>1 Controller Inhibit                                                                                                                                                              | Lecom Only                                                                                                     |
| P625 | Network Timeout              | 10.0              | 0.0 - 300.0 seconds                                                                                                                                                                               | Modbus                                                                                                         |
|      |                              | 50                | 0 - 65000 milliseconds                                                                                                                                                                            | Lecom                                                                                                          |
| P626 | Network Timeout Action       | 4                 | 0 No action<br>1 Stop (P111)<br>2 Quick Stop<br>3 Controller Inhibit<br>4 Trip Fault, F.nF1                                                                                                       | Modbus                                                                                                         |
|      |                              | 0                 | 0 No action<br>1 Controller Inhibit<br>2 Quick Stop<br>3 Trip Fault, F.nF1                                                                                                                        | Lecom                                                                                                          |
| P627 | Network Messages Received    |                   | Read-Only: 0 - 9999<br><b>NOTE:</b> When the number of messages exceeds 9999, the counter resets and resumes counting from 0.                                                                     | Valid network messages received                                                                                |





## 4.5.9 Sequencer Parameters

The P700 Sequencer parameters are listed herein. Refer to section 4.5.7 for P56x Sequencer Diagnostic Parameters. The sequencer function consists of 16 step segments, each individual step segment can have its own ramp time, time spent in individual segment and output frequency entered. The sequencer has 3 different modes to control how the drive moves through each individual step segment: Timer Transition, Step Sequence or Timer and Step Sequence.

### P700= 1 (Timer Transition)

Starting at the segment number entered in the "Start Segment" parameter, the drive will automatically move through each of the segments. The time spent in each segment is determined by the values set in the individual "Time in Current Step" parameters.

### P700= 2 (Step Sequence)

Starting at the segment number entered in the "Start Segment" parameter the sequencer will only move to the next segment when a rising edge is applied to the highest priority digital input which is programmed to "Step Sequence" selection "24".

### P700= 3 (Timer Transition or Step Sequence)

Starting at the segment number entered in the "Start Segment" parameter, the drive will automatically move through each of the segments. The time spent in each segment is determined by the values set in the individual "Time in Current Step" parameters, however if a rising edge is applied to the highest priority digital input which is programmed to "Step Sequence" selection "24" it will force the sequencer to step into the next segment.

**NOTE:** A value of "0" in the "Time in current step" parameter (ex: P712), will result in the segment being skipped.

| Code                |                                                                | Possible Settings |                                                                                                                                                                                | IMPORTANT                                                                                                                                   |
|---------------------|----------------------------------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| No.                 | Name                                                           | Default           | Selection                                                                                                                                                                      |                                                                                                                                             |
| P700                | Sequencer Mode                                                 | 0                 | 0 Disabled<br>1 Enabled: transition on timer only<br>2 Enabled: transition on rising edge (P121, 122, 123 = 25 step sequence)<br>3 Enabled: transition on timer or rising edge | If P700 = 0 and no reference (P121, P101) points to any of the sequence segments, then P701-P799 will not be displayed on the local keypad. |
| P701                | Sequencer: TB13A Trigger Segment                               | 1                 | 1 - 16<br>TB13A = lowest priority                                                                                                                                              |                                                                                                                                             |
| P702                | Sequencer: TB13B Trigger Segment                               | 1                 | 1 - 16<br>TB13B: higher priority than TB13A                                                                                                                                    |                                                                                                                                             |
| P703                | Sequencer: TB13C Trigger Segment                               | 1                 | 1 - 16<br>TB13C: higher priority than TB13B, A                                                                                                                                 |                                                                                                                                             |
| P704 <sup>(2)</sup> | Sequencer: TB13D Trigger Segment                               | 1                 | 1 - 16<br>TB13D: higher priority than TB13C, B, A                                                                                                                              | Asserting TB13D with selection #24 (Start Sequence), starts the sequence operation from the segment specified in this parameter.            |
| P706                | Sequencer: Action after Stop/Start transition or Fault Restart | 0                 | 0 Restart at beginning of sequence<br>1 Restart at beginning of current seg<br>2 Start at beginning of prior segment<br>3 Start at beginning of next segment                   | Pointed by TB13x                                                                                                                            |
| P707                | Sequencer: Number of cycles                                    | 1                 | 1 65535                                                                                                                                                                        | 1 = single scan; 65535 = continuous loop                                                                                                    |

(2) Parameter applicable to SMV models 15HP (11kW) and higher.



# Commissioning

| Code                     |                                     | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 | IMPORTANT                                                                |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|--------------------------|-------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|--------------------------------------------------------------------------|---------------------------------------------------------------|---|---|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|--------------------------|---|---|---|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                      | Name                                | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |                                                                          |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P708                     | Sequencer: Time units/scaling       | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.1              | {sec}           | 6553.5                                                                   | Setup units/scaling for all sequencer time related parameters |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|                          |                                     |                   | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | {sec}           | 65535                                                                    |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|                          |                                     |                   | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | {min}           | 65535                                                                    |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|                          |                                     |                   | <b>NOTE:</b><br>P708 rescales the following sequencer related parameters:<br>- Segment Times in current step: P712, P717, P722, P727, P732, P737, P742, P747, P752, P757, P762, P767, P772, P777, P782, P787, P792<br>- Sequence diagnostic/status: P561, P562                                                                                                                                                                                                                                                                                                                                     |                  |                 |                                                                          |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #1               |                                     |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P710                     | Segment #1 Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P711                     | Segment #1 Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P712                     | Segment #1 Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P713                     | Segment #1 Digital Output State     | 0                 | <table><tr><td>Value set in P713</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 |                                                                          | Value set in P713                                             | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P713        | 0                                   | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6                                                             | 7 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                   | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0                                                             | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                   | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1                                                             | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                   | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1                                                             | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P714                     | Segment #1 TB30 Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #2               |                                     |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P715                     | Segment #2 Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P716                     | Segment #2 Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P717                     | Segment #2 Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P718                     | Segment #2 Digital Output State     | 0                 | <table><tr><td>Value set in P718</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 |                                                                          | Value set in P718                                             | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P718        | 0                                   | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6                                                             | 7 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                   | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0                                                             | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                   | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1                                                             | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                   | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1                                                             | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P719                     | Segment #2 TB30 Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |                                                               |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |

# Commissioning



| Code                     |                                        | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 | IMPORTANT                                                                |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|--------------------------|----------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|--------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|--------------------------|---|---|---|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                      | Name                                   | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #3               |                                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P120                     | Segment #3<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P121                     | Segment #3<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P122                     | Segment #3<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P123                     | Segment #3<br>Digital Output State     | 0                 | <table><tr><td>Value set in P723</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P723                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P723        | 0                                      | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                      | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                      | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                      | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P124                     | Segment #3 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #4               |                                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P125                     | Segment #4<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P126                     | Segment #4<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P127                     | Segment #4<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P128                     | Segment #4<br>Digital Output State     | 0                 | <table><tr><td>Value set in P728</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P728                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P728        | 0                                      | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                      | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                      | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                      | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P129                     | Segment #4 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #5               |                                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P130                     | Segment #5<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P131                     | Segment #5<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P132                     | Segment #5<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P133                     | Segment #5<br>Digital Output State     | 0                 | <table><tr><td>Value set in P733</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P733                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P733        | 0                                      | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                      | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                      | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                      | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P134                     | Segment #5 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |



# Commissioning

| Code                     |                                        | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 | IMPORTANT                                                                |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|--------------------------|----------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|--------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|--------------------------|---|---|---|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                      | Name                                   | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #6               |                                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P135                     | Segment #6<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P136                     | Segment #6<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P137                     | Segment #6<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P138                     | Segment #6<br>Digital Output State     | 0                 | <table><tr><td>Value set in P738</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P738                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P738        | 0                                      | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                      | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                      | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                      | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P139                     | Segment #6 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #7               |                                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P140                     | Segment #7<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P141                     | Segment #7<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P142                     | Segment #7<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P143                     | Segment #7<br>Digital Output State     | 0                 | <table><tr><td>Value set in P743</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P743                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P743        | 0                                      | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                      | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                      | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                      | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P144                     | Segment #7 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #8               |                                        |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P145                     | Segment #8<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P146                     | Segment #8<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P147                     | Segment #8<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P148                     | Segment #8<br>Digital Output State     | 0                 | <table><tr><td>Value set in P748</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P748                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P748        | 0                                      | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                      | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                      | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                      | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P149                     | Segment #8 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |

# Commissioning



| Code                     |                                      | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 | IMPORTANT                                                                |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|--------------------------|--------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|--------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|--------------------------|---|---|---|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                      | Name                                 | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #9               |                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P750                     | Segment #9 Frequency Setpoint        | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P751                     | Segment #9 Accel/Decel Time          | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P752                     | Segment #9 Time in current step      | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P753                     | Segment #9 Digital Output State      | 0                 | <table><tr><td>Value set in P753</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P753                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P753        | 0                                    | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                    | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                    | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                    | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P754                     | Segment #9 TB30 Analog Output Value  | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #10              |                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P755                     | Segment #10 Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P756                     | Segment #10 Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P757                     | Segment #10 Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P758                     | Segment #10 Digital Output State     | 0                 | <table><tr><td>Value set in P758</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P758                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P758        | 0                                    | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                    | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                    | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                    | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P759                     | Segment #10 TB30 Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #11              |                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P760                     | Segment #11 Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P761                     | Segment #11 Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P762                     | Segment #11 Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P763                     | Segment #11 Digital Output State     | 0                 | <table><tr><td>Value set in P763</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1). |                  |                 | Value set in P763                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P763        | 0                                    | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                    | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                    | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                    | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P764                     | Segment #11 TB30 Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |



# Commissioning

| Code                     |                                         | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                 | IMPORTANT                                                                |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|--------------------------|-----------------------------------------|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|--------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|--------------------------|---|---|---|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                      | Name                                    | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #12              |                                         |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P765                     | Segment #12<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P766                     | Segment #12<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P767                     | Segment #12<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P768                     | Segment #12<br>Digital Output State     | 0                 | <table><tr><td>Value set in P768</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</p> |                  |                 | Value set in P768                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P768        | 0                                       | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                       | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                       | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                       | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P769                     | Segment #12 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #13              |                                         |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P770                     | Segment #13<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P771                     | Segment #13<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P772                     | Segment #13<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P773                     | Segment #13<br>Digital Output State     | 0                 | <table><tr><td>Value set in P773</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</p> |                  |                 | Value set in P773                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P773        | 0                                       | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                       | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                       | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                       | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P774                     | Segment #13 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #14              |                                         |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |                 |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P775                     | Segment #14<br>Frequency Setpoint       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P776                     | Segment #14<br>Accel/Decel Time         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | {sec}            | 3600.0          |                                                                          |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P777                     | Segment #14<br>Time in current step     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P778                     | Segment #14<br>Digital Output State     | 0                 | <table><tr><td>Value set in P778</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table> <p>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZAL0, ESVZAL1).</p> |                  |                 | Value set in P778                                                        | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P778        | 0                                       | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3                | 4               | 5                                                                        | 6 | 7 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                       | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0               | 1                                                                        | 0 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                       | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1                | 0               | 0                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                       | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 0                | 1               | 1                                                                        | 1 | 1 |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P779                     | Segment #14 TB30<br>Analog Output Value | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |

# Commissioning



| Code                     |                                                      | Possible Settings |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 | IMPORTANT                                                                |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
|--------------------------|------------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------|--------------------------------------------------------------------------|-------------------|---|---|---|---|---|---|---|---|---------------|---|---|---|---|---|---|---|---|--------------|---|---|---|---|---|---|---|---|--------------------------|---|---|---|---|---|---|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No.                      | Name                                                 | Default           | Selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |                 |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #15              |                                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P780                     | Segment #15 Frequency Setpoint                       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P781                     | Segment #15 Accel/Decel Time                         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P782                     | Segment #15 Time in current step                     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P783                     | Segment #15 Digital Output State                     | 0                 | <table><tr><td>Value set in P783</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZALO, ESVZAL1). |                  |                 |                                                                          | Value set in P783 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P783        | 0                                                    | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6                 | 7 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                                    | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                                    | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                                    | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P784                     | Segment #15 TB30 Analog Output Value                 | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Segment #16              |                                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P785                     | Segment #16 Frequency Setpoint                       | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P786                     | Segment #16 Accel/Decel Time                         | 20.0              | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P787                     | Segment #16 Time in current step                     | 0.0<br>0          | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708<br>Skip segment if time = 0                 |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P788                     | Segment #16 Digital Output State                     | 0                 | <table><tr><td>Value set in P788</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZALO, ESVZAL1). |                  |                 |                                                                          | Value set in P788 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P788        | 0                                                    | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6                 | 7 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                                    | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                                    | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                                    | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P789                     | Segment #16 TB30 Analog Output Value                 | 0.00              | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | {VDC}            | 10.00           | TB30 configuration parameter must be set to accept this value: P150 = 10 |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| End Segment              |                                                      |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |                 |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P790                     | End Segment: Frequency Setpoint                      | 0.0               | -500.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | {Hz}             | 500.0           | If P112 = 1, negative sign forces reverse direction                      |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P791                     | End Segment: Accel/Decel Time                        | 5.0               | 0.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | {sec}            | 3600.0          |                                                                          |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P792                     | End Segment: Delay before P793, 794 & 795 activation |                   | 0.0<br>0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | {P708}<br>{P708} | 6553.5<br>65535 | Scaling/units depend on P708                                             |                   |   |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| P793                     | End Segment: Digital Output State                    |                   | <table><tr><td>Value set in P793</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Relay (Bit 0)</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>TB14 (Bit 1)</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>I/O option Relay (Bit 2)</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr></table><br>NOTE: P441 is the Relay Output (TB-19, 20, 21) of the optional Digital I/O module (ESVZALO, ESVZAL1). |                  |                 |                                                                          | Value set in P793 | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | Relay (Bit 0) | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | TB14 (Bit 1) | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | I/O option Relay (Bit 2) | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | bit = 0: OFF (De-energized)<br>bit = 1: ON (Energized)<br>The corresponding digital output/relay must be set to accept data from the sequencer: P140, P142, P441 = 27 |
| Value set in P793        | 0                                                    | 1                 | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3                | 4               | 5                                                                        | 6                 | 7 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| Relay (Bit 0)            | 0                                                    | 1                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 1                                                                        | 0                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| TB14 (Bit 1)             | 0                                                    | 0                 | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1                | 0               | 0                                                                        | 1                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |
| I/O option Relay (Bit 2) | 0                                                    | 0                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0                | 1               | 1                                                                        | 1                 | 1 |   |   |   |   |   |   |   |               |   |   |   |   |   |   |   |   |              |   |   |   |   |   |   |   |   |                          |   |   |   |   |   |   |   |   |                                                                                                                                                                       |



# Commissioning

| Code |                                       | Possible Settings                                                                 |                                                                                                                                                                                                                                                                  |                       |       | IMPORTANT                                                                                                     |
|------|---------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-------|---------------------------------------------------------------------------------------------------------------|
| No.  | Name                                  | Default                                                                           | Selection                                                                                                                                                                                                                                                        |                       |       |                                                                                                               |
| P794 | End Segment: TB30 Analog Output Value | 0.00                                                                              | 0.00                                                                                                                                                                                                                                                             | {VDC}                 | 10.00 | TB30 configuration parameter must be set to accept this value: P150 = 10                                      |
| P795 | End Segment: Drive Action             | 0                                                                                 | 0                                                                                                                                                                                                                                                                | Keep Running          |       | Recovery: Toggling the START SEQUENCE will start the cycle from 'end segment Stop' or 'end segment DC Brake'. |
|      |                                       |                                                                                   | 1                                                                                                                                                                                                                                                                | Stop (based on P111)  |       |                                                                                                               |
|      |                                       |                                                                                   | 2                                                                                                                                                                                                                                                                | Coast to Stop         |       |                                                                                                               |
|      |                                       |                                                                                   | 3                                                                                                                                                                                                                                                                | Quick Stop (per P127) |       |                                                                                                               |
|      |                                       |                                                                                   | 4                                                                                                                                                                                                                                                                | Coast with DC Brake   |       |                                                                                                               |
|      |                                       |                                                                                   | 5                                                                                                                                                                                                                                                                | Ramp with DC Brake    |       |                                                                                                               |
|      |                                       |  | <b>WARNING!</b><br>If P795 = 0 then toggling the start sequence input will also restart the sequencer cycle but in the interim where TB13X is open the drive will ramp to the standard or specified alternate speed source depending on the drive configuration. |                       |       |                                                                                                               |

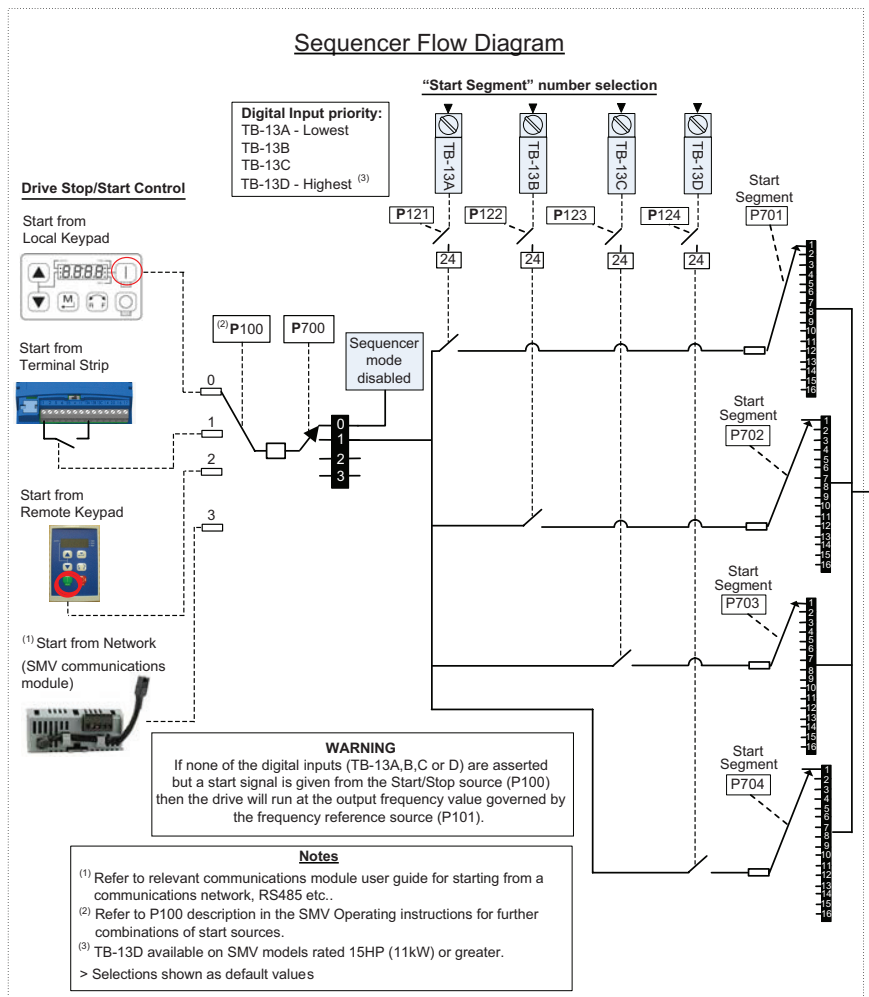


## WARNING

If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).



## 4.5.9.1 Sequencer Flow Diagram Left



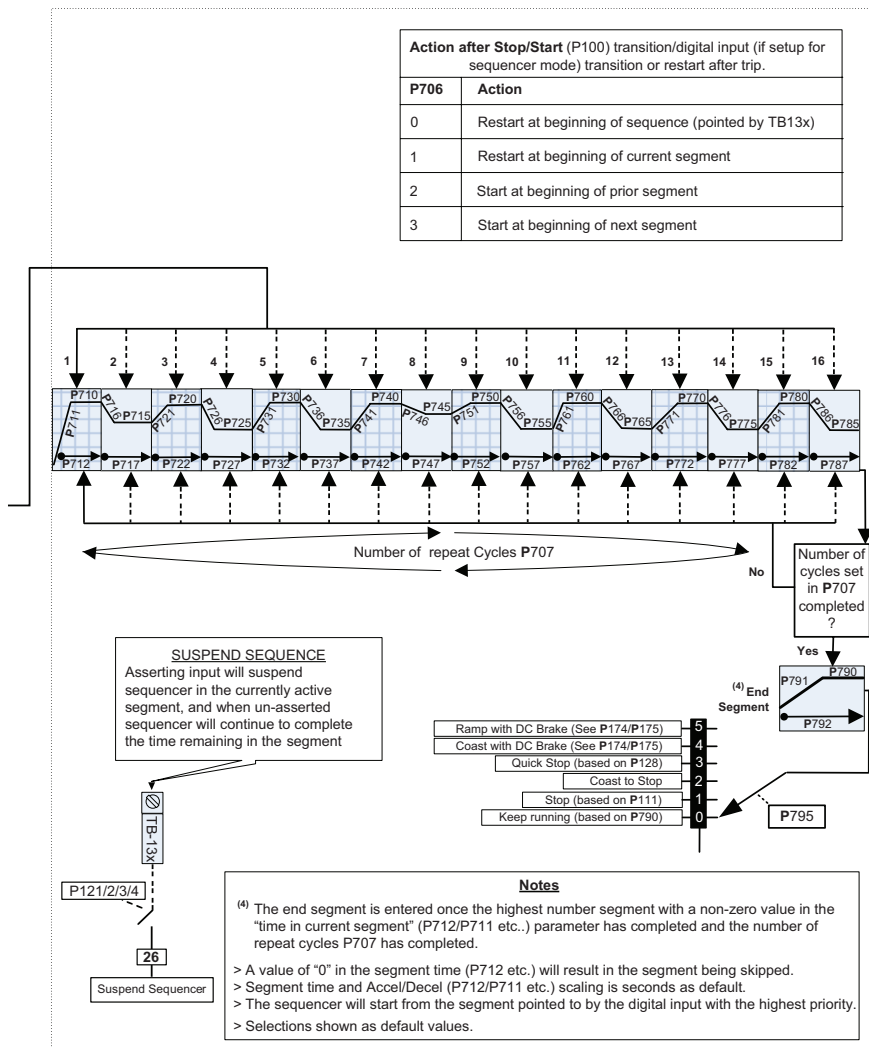
### WARNING

If the input defined to “Start Sequence” is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).

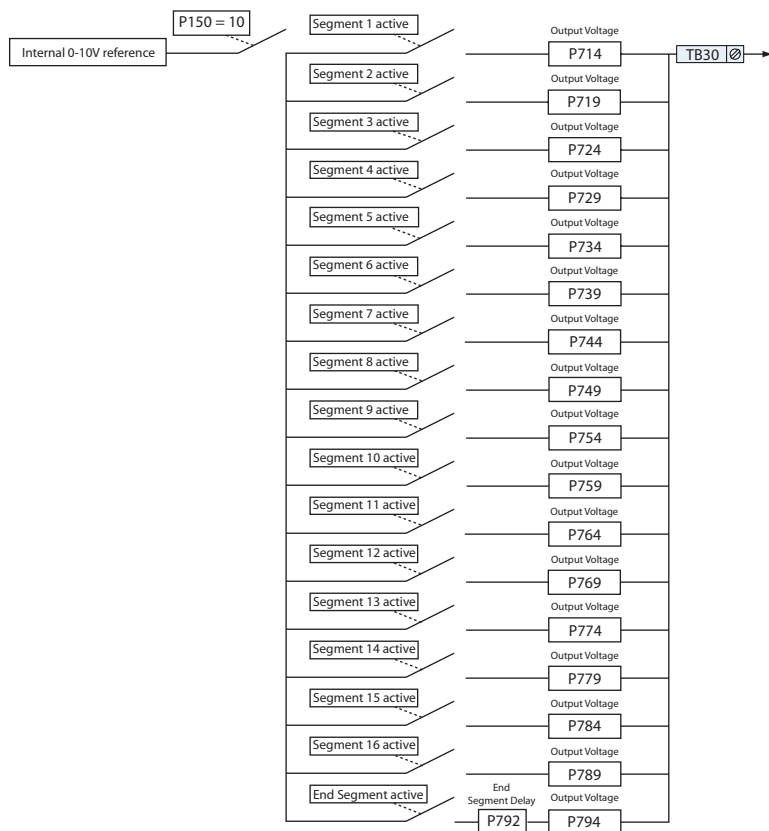


# Commissioning

## 4.5.9.2 Sequencer Flow Diagram Right



## 4.5.9.3 Sequencer Status



### NOTE

On the "End Segment", the output voltage is not present until after the end segment delay P792 has expired. On the other segments the output voltage is present on entry to the segment. The same is true for the digital outputs.

(1) The drive can only be restarted if the error message has been reset.



# Troubleshooting and Diagnostics

## 5 Troubleshooting and Diagnostics

### 5.1 Status/Warning Messages

| Status / Warning                                                                              | Cause                                                                                                                                                                                                       | Remedy                                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>br</b> DC-injection brake active                                                           | DC-injection brake activated <ul style="list-style-type: none"> <li>activation of digital input (P121...P124 = 18)</li> <li>automatically (P110 = 2, 4...6)</li> <li>automatically (P111 = 1, 3)</li> </ul> | Deactivate DC-injection brake <ul style="list-style-type: none"> <li>deactivate digital input</li> <li>automatically after P175 time has expired</li> </ul>                                                       |
| <b>bF</b> Drive ID warning                                                                    | The Drive ID (P502) stored on the EPM does not match the drive model.                                                                                                                                       | <ul style="list-style-type: none"> <li>Verify motor data (P302...P306) and perform Auto Calibration.</li> <li>Set drive mode (P300) to 0 or 1</li> <li>Reset the drive (P199 to 3 or 4) and reprogram.</li> </ul> |
| <b>CAL</b> Motor Auto-calibration active                                                      | Refer to P300, P399                                                                                                                                                                                         | Motor Auto-calibration is being performed                                                                                                                                                                         |
| <b>cE</b> An EPM that contains valid data from a previous software version has been installed | An attempt was made to change parameter settings                                                                                                                                                            | Parameter settings can only be changed after the EPM data is converted to the current version (P199 = 5)                                                                                                          |
| <b>CL</b> Current Limit (P171) reached                                                        | Motor overload                                                                                                                                                                                              | <ul style="list-style-type: none"> <li>Increase P171</li> <li>Verify drive/motor are proper size for application</li> </ul>                                                                                       |
| <b>dEC</b> Decel Override                                                                     | The drive has stopped decelerating to avoid tripping into <b>HF</b> fault, due to excessive motor regen (2 sec max).                                                                                        | If drive trips into <b>HF</b> fault: <ul style="list-style-type: none"> <li>Increase P105, P126</li> <li>Install Dynamic Braking option</li> </ul>                                                                |
| <b>Err</b> Error                                                                              | Invalid data was entered, or an invalid command was attempted                                                                                                                                               |                                                                                                                                                                                                                   |
| <b>FCL</b> Fast Current Limit                                                                 | Overload                                                                                                                                                                                                    | Verify drive/motor are proper size for application                                                                                                                                                                |
| <b>FSt</b> Flying Restart Attempt after Fault                                                 | P110 = 5,6                                                                                                                                                                                                  |                                                                                                                                                                                                                   |
| <b>GE</b> OEM Settings Operation warning                                                      | An attempt was made to change parameter settings while the drive is operating in OEM Settings mode.                                                                                                         | In OEM Settings mode (P199 = 1), making changes to parameters is not permitted.                                                                                                                                   |
| <b>GF</b> OEM Defaults data warning                                                           | An attempt was made to use (or reset to) the OEM default settings (P199 = 1 or 2) using an EPM without valid OEM data.                                                                                      | Install an EPM containing valid OEM Defaults data                                                                                                                                                                 |
| <b>LC</b> Fault Lockout                                                                       | The drive attempted 5 restarts after a fault but all attempts were unsuccessful (P110 = 3...6)                                                                                                              | <ul style="list-style-type: none"> <li>Drive requires manual reset</li> <li>Check Fault History (P500) and correct fault condition</li> </ul>                                                                     |
| <b>PdEC</b> PID Deceleration Status                                                           | PID setpoint has finished its ramp but the drive is still decelerating to a stop.                                                                                                                           |                                                                                                                                                                                                                   |
| <b>PId</b> PID Mode Active                                                                    | Drive has been put into PID Mode.                                                                                                                                                                           | Refer to P200                                                                                                                                                                                                     |
| <b>SLP</b> Sleep Mode is active                                                               | Refer to P240...P242                                                                                                                                                                                        |                                                                                                                                                                                                                   |
| <b>SP</b> Start Pending                                                                       | The drive has tripped into a fault and will automatically restart (P110 = 3...6)                                                                                                                            | To disable Auto-Restart, set P110 = 0...2                                                                                                                                                                         |
| <b>SPd</b> PID Mode disabled.                                                                 | Drive has been taken out of PID Mode. Refer to P200.                                                                                                                                                        |                                                                                                                                                                                                                   |
| <b>StoP</b> Output frequency = 0 Hz (outputs U, V, W inhibited)                               | Stop has been commanded from the keypad, terminal strip, or network                                                                                                                                         | Apply Start command (Start Control source depends on P100)                                                                                                                                                        |

(1) The drive can only be restarted if the error message has been reset.



## 5.2 Drive Configuration Messages

When the Mode button is pressed and held, the drive's display will provide a 4-digit code that indicates how the drive is configured. If the drive is in a Stop state when this is done, the display will also indicate which control source commanded the drive to Stop (the two displays will alternate every second).

| Configuration Display                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                    |                                                                                                                         |                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Format = x.y.z</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>x = Control Source:</b><br><b>L</b> = Local Keypad<br><b>t</b> = Terminal Strip<br><b>r</b> = Remote Keypad<br><b>n</b> = Network                                                                               | <b>y = Mode:</b><br><b>S</b> = Speed mode<br><b>P</b> = PID mode<br><b>t</b> = Torque mode<br><b>C</b> = Sequencer mode | <b>zz = Reference:</b><br><b>CP</b> = Keypad ▲ ▼<br><b>EU</b> = 0-10 VDC (TB-5)<br><b>EI</b> = 4-20 mA (TB-25)<br><b>JG</b> = Jog<br><b>nt</b> = Network<br><b>OP</b> = MOP<br><b>P L...P7</b> = Preset 1...7<br><b>Q L...16</b> = Sequencer Segment |
| <b>Example:</b><br><b>L.S.CP</b> = Local Keypad Start control, Speed mode, Keypad speed reference<br><b>t.P.EU</b> = Terminal Strip Start control, PID mode, 0-10 VDC setpoint reference<br><b>t.C.I2</b> = Terminal Strip Start control, Sequencer Operation (Speed mode), Segment #12<br><b>n.t.P2</b> = Network Start control, Vector Torque mode, Preset Torque #2 reference<br><b>n.S.O3</b> = Network Start control, Speed mode, Speed reference from Sequencer segment #03 |                                                                                                                                                                                                                    |                                                                                                                         |                                                                                                                                                                                                                                                      |
| Stop Source Display                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                    |                                                                                                                         |                                                                                                                                                                                                                                                      |
| <b>Format = x.StP</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>L.StP</b> = Stop command came from Local Keypad<br><b>t.StP</b> = Stop command came from Terminal Strip<br><b>r.StP</b> = Stop command came from Remote Keypad<br><b>n.StP</b> = Stop command came from Network |                                                                                                                         |                                                                                                                                                                                                                                                      |

## 5.3 Fault Messages

The messages below show how they will appear on the display when the drive trips. When looking at the Fault History (P500), the **F\_** will not appear in the fault message.

| Fault        | Cause                    | Remedy <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>F.AF</b>  | High Temperature fault   | Drive is too hot inside <ul style="list-style-type: none"> <li>• Reduce drive load</li> <li>• Improve cooling</li> </ul>                                                                                                                                                                                                                                                                                                                                                                      |
| <b>F.AL</b>  | Assertion Level fault    | <ul style="list-style-type: none"> <li>• Assertion Level switch is changed during operation</li> <li>• P120 is changed during operation</li> <li>• P100 or P121...P124 are set to a value other than 0 and P120 does not match the Assertion Level Switch.</li> </ul> <ul style="list-style-type: none"> <li>• Make sure the Assertion Level switch and P120 are both set for the type of input devices being used, prior to setting P100 or P121...P124.</li> </ul> Refer to 3.2.3 and P120. |
| <b>F.bF</b>  | Personality fault        | Drive Hardware                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>F.CF</b>  | Control fault            | An EPM has been installed that is either blank or corrupted                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>F.cF</b>  | Incompatible EPM fault   | An EPM has been installed that contains data from an incompatible parameter version                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>F.cFt</b> | Forced Translation fault | An EPM from an old drive put in new drive causes drive to trip <b>F.cFt</b> fault.                                                                                                                                                                                                                                                                                                                                                                                                            |
|              |                          | Press [M] (mode button) twice to reset                                                                                                                                                                                                                                                                                                                                                                                                                                                        |



## Troubleshooting and Diagnostics

| Fault                | Cause                                           | Remedy <sup>(1)</sup>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>F_dbF</b>         | Dynamic Braking fault                           | Dynamic braking resistors are overheating <ul style="list-style-type: none"> <li>• Increase active decel time (P105, P126, P127).</li> <li>• Check mains voltage and P107</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>F_EF</b>          | External fault                                  | <ul style="list-style-type: none"> <li>• P121...P124 = 21 and that digital input has been opened.</li> <li>• P121...P124 = 22 and that digital input has been closed.</li> </ul> <ul style="list-style-type: none"> <li>• Correct the external fault condition</li> <li>• Make sure digital input is set properly for NC or NO circuit</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>F_F I</b>         | EPM fault                                       | EPM missing or defective                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>F_F2</b><br>...   | Internal faults                                 | Power down and replace EPM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>F_F I2</b>        |                                                 | Contact factory technical support                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>F_Fnr</b>         | Control Configuration Fault                     | <p>The drive is setup for REMOTE KEYPAD control (P100=2 or 5) but is not setup to communicate with a remote keypad</p> <p>The drive is setup for NETWORK ONLY control (P100=3) but is not setup for network communications</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                      |                                                 | Set P400 = 1, or P600 = 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                      |                                                 | Set P400 or P600 to a valid network communications protocol selection                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>F_FoL</b>         | TB25 (4-20 mA signal) Threshold fault           | 4-20 mA signal (at TB-25) drops below the value set in P164. <ul style="list-style-type: none"> <li>• Check signal/signal wire</li> <li>• Refer to parameters P163 and P164.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>F_GF</b>          | OEM Defaults data fault                         | Drive is powered up with P199 =1 and OEM settings in the EPM are not valid. <p>Install an EPM containing valid OEM Defaults data or change P199 to 0.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>F_HF</b>          | High DC Bus Voltage fault                       | Mains voltage is too high <p>Check mains voltage and P107</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                      |                                                 | Decel time is too short, or too much regen from motor <p>Increase active decel time (P105, P126, P127) or install Dynamic Braking option</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>F_IL</b>          | Digital Input Configuration fault (P121...P124) | <p>More than one digital input set for the same function</p> <p>Each setting can only be used once (except settings 0 and 3)</p> <p>Only one digital input configured for MOP function (Up, Down)</p> <p>One input must be set to MOP Up, another must be set to MOP Down</p> <p>PID mode is entered with setpoint reference and feedback source set to the same analog signal</p> <p>Change PID setpoint reference (P121...P124) or feedback source (P201).</p> <p>One of the digital inputs (P121...P124) is set to 10 and another is set to 11...14.</p> <p>One of the digital inputs (P121...P124) is set to 11 or 12 and another is set to 13 or 14.</p> <p>Reconfigure digital inputs</p> <p>PID enabled in Vector Torque mode (P200 = 1 or 2 and P300 = 5)</p> <p>PID cannot be used in Vector Torque mode</p> |
| <b>F_JF</b>          | Remote keypad fault                             | Remote keypad disconnected <p>Check remote keypad connections</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>F_LF</b>          | Low DC Bus Voltage fault                        | Mains voltage too low <p>Check mains voltage</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>F_n Id</b>        | No Motor ID fault                               | An attempt was made to start the drive in Vector or Enhanced V/Hz mode prior to performing the Motor Auto-calibration <p>Refer to parameters P300...P399 for Drive Mode setup and calibration.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>F_nLF</b>         | Module communication fault                      | Communication failure between drive and Network Module. <p>Check module connections</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>F_nF I</b><br>... | Network Faults                                  | Refer to the module documentation. for Causes and Remedies.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>F_nF9</b>         |                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |



| Fault         |                                    | Cause                                                                                                                                                  | Remedy <sup>(1)</sup>                                                                                                                                                                                    |
|---------------|------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>F_DF</b>   | Output fault:<br>Transistor fault  | Output short circuit                                                                                                                                   | Check motor/motor cable                                                                                                                                                                                  |
|               |                                    | Acceleration time too short                                                                                                                            | Increase P104, P125                                                                                                                                                                                      |
|               |                                    | Severe motor overload, due to: <ul style="list-style-type: none"> <li>• Mechanical problem</li> <li>• Drive/motor too small for application</li> </ul> | <ul style="list-style-type: none"> <li>• Check machine / system</li> <li>• Verify drive/motor are proper size for application</li> </ul>                                                                 |
|               |                                    | Boost values too high                                                                                                                                  | Decrease P168, P169                                                                                                                                                                                      |
|               |                                    | Excessive capacitive charging current of the motor cable                                                                                               | <ul style="list-style-type: none"> <li>• Use shorter motor cables with lower charging current</li> <li>• Use low capacitance motor cables</li> <li>• Install reactor between motor and drive.</li> </ul> |
|               |                                    | Failed output transistor                                                                                                                               | Contact factory technical support                                                                                                                                                                        |
| <b>F_DF I</b> | Output fault: Ground fault         | Grounded motor phase                                                                                                                                   | Check motor and motor cable                                                                                                                                                                              |
|               |                                    | Excessive capacitive charging current of the motor cable                                                                                               | Use shorter motor cables with lower charging current                                                                                                                                                     |
| <b>F_PF</b>   | Motor Overload fault               | Excessive motor load for too long                                                                                                                      | <ul style="list-style-type: none"> <li>• Verify proper setting of P108</li> <li>• Verify drive and motor are proper size for application</li> </ul>                                                      |
| <b>F_rF</b>   | Flying Restart fault               | Controller was unable to synchronize with the motor during restart attempt; (P110 = 5 or 6)                                                            | Check motor / load                                                                                                                                                                                       |
| <b>F_SF</b>   | Single-Phase fault                 | A mains phase has been lost                                                                                                                            | Check mains voltage                                                                                                                                                                                      |
| <b>F_UF</b>   | Start fault                        | Start command was present when power was applied (P110 = 0 or 2).                                                                                      | <ul style="list-style-type: none"> <li>• Must wait at least 2 seconds after power-up to apply Start command</li> <li>• Consider alternate starting method (P110).</li> </ul>                             |
| <b>F_FAU</b>  | TB5 (0-10V signal) Threshold fault | 0-10V signal (at TB5) drops below the value set in P158.                                                                                               | <ul style="list-style-type: none"> <li>• Check signal/signal wire</li> <li>• Refer to parameters P157 and P158</li> </ul>                                                                                |

(1) The drive can only be restarted if the error message has been reset.



# Appendix

## Appendix A

### A.1 Permissible Cable Lengths

The table herein lists the permissible cable lengths for use with an SMV inverter with an internal EMC filter.



#### NOTE

This table is intended as a reference guideline only; application results may vary. The values in this table are based on testing with commonly available low-capacitance shielded cable and commonly available AC induction motors. Testing is conducted at worst case speeds and loads.

| Maximum Permissible Cable Lengths (Meters) for SMV Model with Internal EMC Filters |                              |                             |         |                             |         |                             |         |                              |         |
|------------------------------------------------------------------------------------|------------------------------|-----------------------------|---------|-----------------------------|---------|-----------------------------|---------|------------------------------|---------|
| Mains                                                                              | Model                        | 4 kHz Carrier<br>(P166 = 0) |         | 6 kHz Carrier<br>(P166 = 1) |         | 8 kHz Carrier<br>(P166 = 2) |         | 10 kHz Carrier<br>(P166 = 3) |         |
|                                                                                    |                              | Class A                     | Class B | Class A                     | Class B | Class A                     | Class B | Class A                      | Class B |
| 240 V, 1-phase<br>(2/PE)                                                           | ESV251 $\phi\phi$ 2SF $\phi$ | 38                          | 12      | 35                          | 10      | 33                          | 5       | 30                           | N/A     |
|                                                                                    | ESV371 $\phi\phi$ 2SF $\phi$ | 38                          | 12      | 35                          | 10      | 33                          | 5       | 30                           | N/A     |
|                                                                                    | ESV751 $\phi\phi$ 2SF $\phi$ | 38                          | 12      | 35                          | 10      | 33                          | 5       | 30                           | N/A     |
|                                                                                    | ESV112 $\phi\phi$ 2SF $\phi$ | 38                          | 12      | 35                          | 10      | 33                          | 5       | 30                           | N/A     |
|                                                                                    | ESV152 $\phi\phi$ 2SF $\phi$ | 38                          | 12      | 35                          | 10      | 33                          | 5       | 30                           | N/A     |
|                                                                                    | ESV222 $\phi\phi$ 2SF $\phi$ | 38                          | 12      | 35                          | 10      | 33                          | 5       | 30                           | N/A     |
| 400/480 V, 3-phase<br>(3/PE)                                                       | ESV371 $\phi\phi$ 4TF $\phi$ | 30                          | 4       | 25                          | 2       | 20                          | N/A     | 10                           | N/A     |
|                                                                                    | ESV751 $\phi\phi$ 4TF $\phi$ | 30                          | 4       | 25                          | 2       | 20                          | N/A     | 10                           | N/A     |
|                                                                                    | ESV112 $\phi\phi$ 4TF $\phi$ | 30                          | 4       | 25                          | 2       | 20                          | N/A     | 10                           | N/A     |
|                                                                                    | ESV152 $\phi\phi$ 4TF $\phi$ | 30                          | 4       | 25                          | 2       | 20                          | N/A     | 10                           | N/A     |
|                                                                                    | ESV222 $\phi\phi$ 4TF $\phi$ | 30                          | 4       | 25                          | 2       | 20                          | N/A     | 10                           | N/A     |
|                                                                                    | ESV302 $\phi\phi$ 4TF $\phi$ | 30                          | 4       | 25                          | 2       | 20                          | N/A     | 10                           | N/A     |
|                                                                                    | ESV402 $\phi\phi$ 4TF $\phi$ | 54                          | 5       | 48                          | 3       | 42                          | 2       | N/A                          | N/A     |
|                                                                                    | ESV552 $\phi\phi$ 4TF $\phi$ | 54                          | 5       | 48                          | 3       | 42                          | 2       | N/A                          | N/A     |
|                                                                                    | ESV752 $\phi\phi$ 4TF $\phi$ | 54                          | 5       | 48                          | 3       | 42                          | 2       | N/A                          | N/A     |

NOTE: The “ $\phi\phi$ ” and “ $\phi$ ” symbols are place holders in the Model part number that contain different information depending on the specific configuration of the model. Refer to the SMV Type Number Designation table in section 2.2 for more information.



Lenze SMVector 13465100 EDBSV01 EN v18



Lenze Americas Corporation  
630 Douglas Street  
Uxbridge, MA 01569  
USA

 800 217-9100  
 508 278-7873  
 [marketing@lenzeamericas.com](mailto:marketing@lenzeamericas.com)  
 [www.Lenze.com](http://www.Lenze.com)

Service  
Lenze AC Tech Corporation  
630 Douglas Street  
Uxbridge, MA 01569  
USA

 508 278-9100  
 508 278-6620  
 [repair@lenzeamericas.com](mailto:repair@lenzeamericas.com)



## Main

|                           |                                                                                         |
|---------------------------|-----------------------------------------------------------------------------------------|
| Range of product          | Zelio Time                                                                              |
| Product or component type | Modular timing relay                                                                    |
| Discrete output type      | Relay                                                                                   |
| Width                     | 17.5 mm                                                                                 |
| Component name            | RE17R                                                                                   |
| Time delay type           | A<br>At                                                                                 |
| Time delay range          | 0.1...1 s<br>1...10 h<br>1...10 min<br>1...10 s<br>10...100 h<br>6...60 min<br>6...60 s |
| Nominal output current    | 8 A                                                                                     |

## Complementary

|                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contacts material              | Cadmium free                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Control type                   | Selector switch on front panel                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| [Us] rated supply voltage      | 24 V DC<br>24...240 V AC at 50/60 Hz                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Voltage range                  | 0.85...1.1 Us                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Supply frequency               | 50...60 Hz (+/- 5 %)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Release of input voltage       | 10 V                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Connections - terminals        | Screw terminals, clamping capacity: 2 x 0.2...2 x 1.5 mm <sup>2</sup> AWG 24...AWG 16 (flexible) with cable end<br>Screw terminals, clamping capacity: 1 x 0.2...1 x 2.5 mm <sup>2</sup> AWG 24...AWG 14 (flexible) with cable end<br>Screw terminals, clamping capacity: 2 x 0.5...2 x 2.5 mm <sup>2</sup> AWG 20...AWG 14 (solid) without cable end<br>Screw terminals, clamping capacity: 1 x 0.5...1 x 3.3 mm <sup>2</sup> AWG 20...AWG 12 (solid) without cable end |
| Tightening torque              | 0.6...1 N.m conforming to IEC 60947-1                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Housing material               | Self-extinguishing                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Repeat accuracy                | +/- 0.5 % conforming to IEC 61812-1                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Temperature drift              | +/- 0.05 %/°C                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Voltage drift                  | +/- 0.2 %/V                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Setting accuracy of time delay | +/- 10 % of full scale at 25 °C conforming to IEC 61812-1                                                                                                                                                                                                                                                                                                                                                                                                                |
| Control signal pulse width     | 30 ms typical<br>100 ms with load in parallel typical                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Insulation resistance          | 100 MOhm at 500 V DC conforming to IEC 60664-1                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Reset time                     | 120 ms on de-energisation typical                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| On-load factor                 | 100 %                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Power consumption in VA        | <= 32 VA at 240 V AC                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Power consumption in W         | <= 0.6 W at 24 V DC                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Minimum switching current      | 10 mA 5 V DC                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Maximum switching current      | 8 A AC/DC                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Maximum switching voltage      | 250 V AC                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Breaking capacity              | <= 2000 VA                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

|                                        |                                                                                                                                                                                                                                                             |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operating frequency                    | 10 Hz                                                                                                                                                                                                                                                       |
| Electrical durability                  | 100000 cycles for resistive load (8 A at 250 V AC maximum)                                                                                                                                                                                                  |
| Mechanical durability                  | 10000000 cycles                                                                                                                                                                                                                                             |
| Dielectric strength                    | 2.5 kV 1 mA/1 minute 50 Hz conforming to IEC 61812-1                                                                                                                                                                                                        |
| [Uimp] rated impulse withstand voltage | 5 kV (1.2/50 µs)                                                                                                                                                                                                                                            |
| Power on delay                         | < 100 ms                                                                                                                                                                                                                                                    |
| Marking                                | CE                                                                                                                                                                                                                                                          |
| Creepage distance                      | 4 kV/3 conforming to IEC 60664-1                                                                                                                                                                                                                            |
| Mounting position                      | Any position in relation to normal vertical mounting plane                                                                                                                                                                                                  |
| Mounting support                       | 35 mm DIN rail conforming to EN/IEC 60715                                                                                                                                                                                                                   |
| Local signalling                       | LED indicator pulsing: relay de-energised, no timing in progress (except function Di-D, Li-L) (5 % ON and 95 % OFF)<br>LED indicator flashing: timing in progress (80 % ON and 20 % OFF)<br>LED indicator on steady: relay energised, no timing in progress |
| Product weight                         | 0.07 kg                                                                                                                                                                                                                                                     |

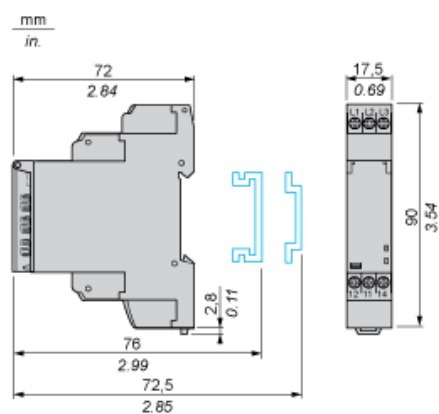
## Environment

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Immunity to microbreaks               | <= 20 ms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Standards                             | 2004/108/EC<br>EN 61000-6-1<br>EN 61000-6-2<br>EN 61000-6-3<br>EN 61000-6-4<br>IEC 61812-1<br>2006/95/EC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Product certifications                | CSA<br>CULus<br>GL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Ambient air temperature for storage   | -30...60 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Ambient air temperature for operation | -20...60 °C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| IP degree of protection               | IP50 (front panel) conforming to IEC 60529<br>IP40 (housing) conforming to IEC 60529<br>IP20 (terminal block) conforming to IEC 60529                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Vibration resistance                  | 20 m/s <sup>2</sup> (f = 10...150 Hz) conforming to IEC 60068-2-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Shock resistance                      | 15 gn (duration = 11 ms) conforming to IEC 60068-2-27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Relative humidity                     | 93 % without condensation conforming to IEC 60068-2-30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Electromagnetic compatibility         | Conducted and radiated emissions conforming to EN 55022 class B<br>Voltage dips and interruptions immunity test, 25/30 cycles at 70 % conforming to IEC 61000-4-11<br>Voltage dips and interruptions immunity test, 1 cycle at 0 % conforming to IEC 61000-4-11<br>Conducted RF disturbances, 0.15...80 MHz at 10 V conforming to IEC 61000-4-6 level 3<br>1.2/50 µs shock waves immunity test, common mode at 2 kV conforming to IEC 61000-4-5 level 3<br>1.2/50 µs shock waves immunity test, differential mode at 1 kV conforming to IEC 61000-4-5 level 3<br>Electrical fast transient/burst immunity test, direct at 2 kV conforming to IEC 61000-4-4 level 3<br>Electrical fast transient/burst immunity test, capacitive connecting clip at 1 kV conforming to IEC 61000-4-4 level 3<br>Susceptibility to electromagnetic fields, 80 MHz to 1 GHz at 10 V/m conforming to IEC 61000-4-3 level 3<br>Electrostatic discharge immunity test, in air at 8 kV conforming to IEC 61000-4-2 level 3<br>Electrostatic discharge immunity test, in contact at 6 kV conforming to IEC 61000-4-2 level 3 |

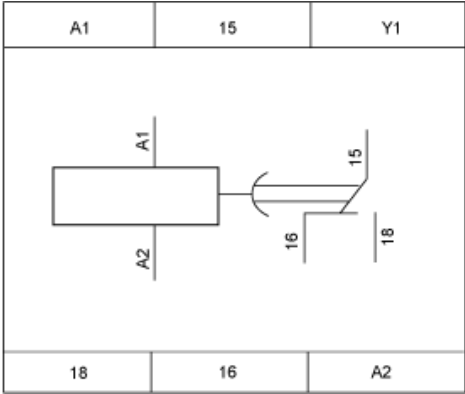
## Offer Sustainability

|                                  |                                                                                       |
|----------------------------------|---------------------------------------------------------------------------------------|
| Sustainable offer status         | Green Premium product                                                                 |
| RoHS (date code: YYWW)           | Compliant - since 1243 - <a href="#">Schneider Electric declaration of conformity</a> |
| REACH                            | Reference not containing SVHC above the threshold                                     |
| Product environmental profile    | Available <a href="#">Download Product Environmental</a>                              |
| Product end of life instructions | Available <a href="#">Download End Of Life Manual</a>                                 |

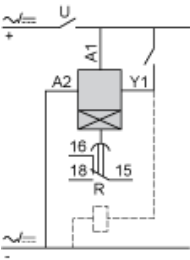
Width 17.5 mm



Internal Wiring Diagram



Wiring Diagram



## Function A : Power on Delay Relay

### Description

The timing period T begins on energisation. After timing, the output(s) R close(s). The second output can be either timed or instantaneous.

#### Function: 1 Output



#### Function: 2 Outputs



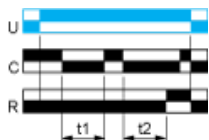
2 timed outputs (R1/R2) or 1 timed output (R1) and 1 instantaneous output (R2 inst.)

## Function At : Power on Delay Relay (Summation) with Control Signal

### Description

After power-up, the first opening of control contact C starts the timing. Timing can be interrupted each time control contact closes. When the cumulative total of time periods elapsed reaches the pre-set value T, the output relay closes.

#### Function: 1 Output



$T = t_1 + t_2 + \dots$

## Legend

- Relay de-energised
- Relay energised
- Output open
- Output closed
- C Control contact
- G Gate
- R Relay or solid state output
- R1/ 2 timed outputs
- R2
- R2 The second output is instantaneous if the right position is selected inst.
- T Timing period
- Ta Adjustable On-delay
- 
- Tr Adjustable Off-delay
- 
- U Supply

## **APPENDIX H**

### **QUALITY ASSURANCE PROJECT PLAN**

---

---

**QUALITY ASSURANCE PROJECT PLAN**  
**Williamsburg Bridgeview Apartments**  
**Brooklyn, New York**  
**NYSDEC Site Number C224233**

---

---

Prepared For:

**LPC Development Group LLC**

Bronx, NY

*Prepared By:*



equity **environmental** engineering

500 International Drive  
Suite 150  
Mt. Olive, NJ 07828

**August 2018**

---



# TABLE OF CONTENTS

|                                                                                                         | <u>PAGE</u> |
|---------------------------------------------------------------------------------------------------------|-------------|
| <b>SECTION 1 PROJECT DESCRIPTION .....</b>                                                              | <b>1</b>    |
| 1.1 INTRODUCTION .....                                                                                  | 1           |
| 1.2 PROJECT Objectives .....                                                                            | 1           |
| 1.3 SCOPE of Work .....                                                                                 | 1           |
| 1.4 DATA quality objectives and processes.....                                                          | 1           |
| <b>SECTION 2 PROJECT ORGANIZATION.....</b>                                                              | <b>3</b>    |
| <b>SECTION 3 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OBJECTIVES<br/>FOR MEASUREMENT OF DATA .....</b> | <b>4</b>    |
| 3.1 INTRODUCTION .....                                                                                  | 4           |
| 3.2 PRECISION.....                                                                                      | 4           |
| 3.3 ACCURACY .....                                                                                      | 5           |
| 3.4 REPRESENTATIVENESS .....                                                                            | 6           |
| 3.5 COMPLETENESS .....                                                                                  | 6           |
| 3.6 COMPARABILITY .....                                                                                 | 7           |
| <b>SECTION 4 SAMPLING PROGRAM.....</b>                                                                  | <b>8</b>    |
| 4.1 INTRODUCTION .....                                                                                  | 8           |
| 4.2 SAMPLE Container Preparation and Sample Preservation .....                                          | 8           |
| 4.3 SAMPLE Holding Times .....                                                                          | 8           |
| 4.4 FIELD QC Samples.....                                                                               | 8           |
| <b>SECTION 5 SAMPLE TRACKING AND CUSTODY.....</b>                                                       | <b>14</b>   |
| 5.1 INTRODUCTION .....                                                                                  | 14          |
| 5.2 FIELD Sample Custody.....                                                                           | 14          |
| 5.3 LABORATORY Sample Custody.....                                                                      | 17          |

---

|                                                                                |           |
|--------------------------------------------------------------------------------|-----------|
| <b>SECTION 6 CALIBRATION PROCEDURES .....</b>                                  | <b>18</b> |
| 6.1 FIELD Instruments .....                                                    | 18        |
| 6.2 LABORATORY Instruments .....                                               | 18        |
| <b>SECTION 7 ANALYTICAL PROCEDURES .....</b>                                   | <b>19</b> |
| <b>SECTION 8 DATA REDUCTION, VALIDATION, AND REPORTING .....</b>               | <b>20</b> |
| 8.1 INTRODUCTION .....                                                         | 20        |
| 8.2 DATA Reduction.....                                                        | 20        |
| 8.3 DATA Validation .....                                                      | 22        |
| <b>SECTION 9 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY.</b>                | <b>24</b> |
| 9.1 QUALITY Assurance Batching .....                                           | 24        |
| 9.2 CALIBRATION Standards and Surrogates.....                                  | 24        |
| 9.3 ORGANIC Blanks and Matrix Spike .....                                      | 24        |
| 9.4 TRIP and Field Blanks.....                                                 | 24        |
| <b>SECTION 10 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS .....</b> | <b>25</b> |
| 10.1 INTRODUCTION .....                                                        | 25        |
| 10.2 SYSTEM Audits.....                                                        | 25        |
| 10.3 PERFORMANCE Audits .....                                                  | 25        |
| 10.4 FORMAL Audits.....                                                        | 25        |
| <b>SECTION 11 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES .....</b>        | <b>27</b> |
| 11.1 PREVENTIVE Maintenance Procedures .....                                   | 27        |
| 11.2 SCHEDULES .....                                                           | 27        |
| 11.3 RECORDS.....                                                              | 27        |
| <b>SECTION 12 CORRECTIVE ACTION .....</b>                                      | <b>28</b> |
| 12.1 INTRODUCTION .....                                                        | 28        |

---

|                                   |           |
|-----------------------------------|-----------|
| 12.2 PROCEDURE Description.....   | 28        |
| <b>SECTION 13 REFERENCES.....</b> | <b>31</b> |

### **LIST OF FIGURES**

|                                             |    |
|---------------------------------------------|----|
| Figure 5.1 Sample Custody .....             | 18 |
| Figure 5.2 Chain-of-Custody Record.....     | 19 |
| Figure 12.1 Corrective Action Request ..... | 33 |

### **LIST OF TABLES**

|                                                                                |    |
|--------------------------------------------------------------------------------|----|
| Table 3 Quality Control Limits for Water Samples .....                         | 5  |
| Table 4.1 Summary of Samples and Analyses .....                                | 15 |
| Table 4.2 Water Sample Containerization, Preservation, and Holding Times ..... | 15 |
| Table 4.3 Soil and Waste Sample Containerization and Holding Times .....       | 16 |
| Table 8.1 Field and Character Lengths for Disk Deliverables .....              | 24 |

## SECTION 1

### PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) specifies analytical methods to be used to ensure that data from the proposed remedial action is precise, accurate, representative, comparable, and complete.

#### 1.1 INTRODUCTION

This QAPP has been prepared by Equity Environmental Engineering, LLC (Equity) for the Williamsburg Bridgeview Apartments (WBA) to investigate soil and groundwater at the Site, located at 337 Berry Street, Brooklyn, New York, Site #C224233.

#### 1.2 PROJECT OBJECTIVES

The objectives of this project are as follows:

1. Installation of soil borings, temporary groundwater monitoring wells, and soil-gas sampling points.
2. Collection of soil, groundwater, soil-gas, and indoor air samples to assist with the delineation of VOC contamination association with past Site operations.

#### 1.3 SCOPE OF WORK

The scope of work includes the installation of monitoring well(s) and the collection of soil-gas, indoor air, and groundwater samples as part of the Site Management Plan (SMP) for the WBA site.

#### 1.4 DATA QUALITY OBJECTIVES AND PROCESSES

The quality assurance and quality control (QA/QC) objectives for all measurement data include:

- **Precision** - an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and matrix spike duplicates.
  - **Accuracy** - a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Sampling accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.
-

- **Representativeness** - expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be determined by assessing a number of investigation procedures, including chain of custody, decontamination, and analysis of field blanks and trip blanks.
- **Completeness** - the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.
- **Comparability** - expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis, instrument calibrations, using standard reporting units and reporting formats.

Each of the above objectives is discussed in detail in Section 3.

## SECTION 2

### PROJECT ORGANIZATION

This Remedial Investigation will be completed for WBA site. Equity Environmental Engineering, LLC (Equity) will coordinate the field activities and provide an on-site field representative to perform the site Health & Safety, soil, soil vapor, and groundwater sampling. Equity will perform the data analysis and all reporting tasks. The analytical services will be performed by an ELAP approved laboratory.

Key contacts for this project are as follows:

LPC Development Group LLC.

Mr. Peter Procida  
Telephone: (973) 242-6521  
Fax: (973) 242-0131

Equity Environmental Engineering  
Project Manager:

Mr. Robert Jackson  
Telephone: (973) 527-7451  
Fax: (973)858-0280

Mr. Peter Jaran, P.E.  
Telephone: (973)-527-7451  
Fax: (973)858-0280

Alpha Analytical Laboratory  
Address: 35 Whitney Rd #5  
Mahwah, NJ 07430

Mr. Pail Simms  
Telephone: (201) 847-9100

## SECTION 3

### QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) OBJECTIVES FOR MEASUREMENT OF DATA

#### 3.1 INTRODUCTION

The quality assurance and quality control (QA/QC) objectives for all measurement data include precision, accuracy, representativeness, completeness, and comparability. These objectives are defined in following subsections. They are formulated to meet the requirements of the USEPA SW-846. The analytical methods are given in Section 7.

#### 3.2 PRECISION

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

- RPD = Relative Percent Difference.
- V1, V2 = The two values to be compared.
- |V1 - V2| = The absolute value of the difference between the two values.
- (V1 + V2)/2 = The average of the two values.

The data quality objectives for analytical precision, calculated as the RPD between duplicate analyses, are presented in the following tables.

### 3.3 ACCURACY

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise". Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where:

|     |   |                                                                                                               |
|-----|---|---------------------------------------------------------------------------------------------------------------|
| %R  | = | Percent recovery.                                                                                             |
| SSR | = | Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.          |
| SR  | = | Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample. |
| SA  | = | Spiked analyte: concentration of the analyte spike added to the sample.                                       |

The acceptance limits for accuracy for each parameter are presented in Table 3.



### 3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the Health and Safety Plan, and according to the NYSDEC DER-10 requirements. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate and Chain-of-custody procedures are presented in Sections 4 and 5.

### 3.5 COMPLETENESS

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

$$\%C = \frac{V}{T} \times 100$$

where:

%C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

### 3.6 COMPARABILITY

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the U.S. Environmental Protection Agency (USEPA) or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all future users of either the data or the conclusions drawn from them will be able to judge the comparability of these data and conclusions.

Table 3

## VOCs

Control Limits (%) Rev: 2/15/18

| Compound                | CAS No.    | RL  | MDL       | Units  | MS/MSD | RPD | BS        | DUP |
|-------------------------|------------|-----|-----------|--------|--------|-----|-----------|-----|
| Acetone                 | 67-64-1    | 10  | 6 ug/l    | 34-149 |        |     | 17 42-150 | 20  |
| Benzene                 | 71-43-2    | 0.5 | 0.43 ug/l | 54-136 |        |     | 10 80-120 | 20  |
| Bromochloro             | 74-97-5    | 1   | 0.48 ug/l | 79-124 |        |     | 11 84-121 | 20  |
| Bromodichloro           | 75-27-4    | 1   | 0.58 ug/l | 79-124 |        |     | 11 83-120 | 20  |
| Bromoforn               | 75-25-2    | 1   | 0.63 ug/l | 71-130 |        |     | 11 76-129 | 20  |
| Bromomet                | 74-83-9    | 2   | 1.5 ug/l  | 53-142 |        |     | 14 57-138 | 20  |
| 2-Butanon               | 78-93-3    | 10  | 6.9 ug/l  | 54-142 |        |     | 15 64-137 | 20  |
| Carbon disulfide        | 75-15-0    | 2   | 0.95 ug/l | 59-145 |        |     | 17 64-137 | 20  |
| Carbon tetrachloride    | 56-23-5    | 1   | 0.55 ug/l | 70-143 |        |     | 12 75-135 | 20  |
| Chlorobenzene           | 108-90-7   | 1   | 0.56 ug/l | 78-123 |        |     | 10 84-117 | 20  |
| Chloroethane            | 75-00-3    | 1   | 0.73 ug/l | 57-141 |        |     | 14 63-132 | 20  |
| Chloroform              | 67-66-3    | 1   | 0.5 ug/l  | 76-123 |        |     | 11 80-119 | 20  |
| Chloromet               | 74-87-3    | 1   | 0.76 ug/l | 43-141 |        |     | 16 46-136 | 20  |
| Cyclohexane             | 110-82-7   | 5   | 0.78 ug/l | 51-155 |        |     | 16 64-137 | 20  |
| 1,2-Dibromochloro       | 96-12-8    | 2   | 1.2 ug/l  | 66-130 |        |     | 13 72-127 | 20  |
| Dibromochloro           | 124-48-1   | 1   | 0.56 ug/l | 76-125 |        |     | 11 80-123 | 20  |
| 1,2-Dibromodichloro     | 106-93-4   | 1   | 0.48 ug/l | 78-119 |        |     | 11 84-117 | 20  |
| 1,2-Dichloro            | 95-50-1    | 1   | 0.53 ug/l | 77-123 |        |     | 11 84-119 | 20  |
| 1,3-Dichloro            | 541-73-1   | 1   | 0.54 ug/l | 76-122 |        |     | 11 81-117 | 20  |
| 1,4-Dichloro            | 106-46-7   | 1   | 0.51 ug/l | 76-122 |        |     | 11 82-117 | 20  |
| Dichlorodifluoromethane | 75-71-8    | 2   | 1.4 ug/l  | 31-159 |        |     | 16 36-149 | 20  |
| 1,1-Dichloro            | 75-34-3    | 1   | 0.57 ug/l | 73-126 |        |     | 11 79-120 | 20  |
| 1,2-Dichloro            | 107-06-2   | 1   | 0.6 ug/l  | 72-131 |        |     | 11 78-126 | 20  |
| 1,1-Dichloro            | 75-35-4    | 1   | 0.59 ug/l | 63-136 |        |     | 14 69-126 | 20  |
| cis-1,2-Dichloro        | 156-59-2   | 1   | 0.51 ug/l | 60-136 |        |     | 11 80-120 | 20  |
| trans-1,2-Dichloro      | 156-60-5   | 1   | 0.54 ug/l | 70-126 |        |     | 11 76-120 | 20  |
| 1,2-Dichloro            | 78-87-5    | 1   | 0.51 ug/l | 78-124 |        |     | 10 82-121 | 20  |
| cis-1,3-Dichloro        | 10061-01-1 | 1   | 0.47 ug/l | 79-123 |        |     | 11 83-120 | 20  |
| trans-1,3-Dichloro      | 10061-02-1 | 1   | 0.43 ug/l | 77-123 |        |     | 11 82-121 | 20  |
| Ethylbenzene            | 100-41-4   | 1   | 0.6 ug/l  | 51-140 |        |     | 20 80-120 | 20  |
| Freon 113               | 76-13-1    | 5   | 1.9 ug/l  | 60-192 |        |     | 14 62-182 | 20  |
| 2-Hexanon               | 591-78-6   | 5   | 2 ug/l    | 56-139 |        |     | 14 65-132 | 20  |
| Isopropylbenzene        | 98-82-8    | 1   | 0.65 ug/l | 75-129 |        |     | 11 83-120 | 20  |
| Methyl Acetate          | 79-20-9    | 5   | 0.8 ug/l  | 55-131 |        |     | 15 67-129 | 20  |
| Methylcyclohexane       | 108-87-2   | 5   | 0.6 ug/l  | 57-155 |        |     | 13 71-134 | 20  |
| Methyl Toluene          | 1634-04-4  | 1   | 0.51 ug/l | 72-123 |        |     | 11 80-119 | 20  |
| 4-Methyl-2-pentanone    | 108-10-1   | 5   | 1.9 ug/l  | 66-136 |        |     | 13 71-131 | 20  |
| Methylene chloride      | 75-09-2    | 2   | 1 ug/l    | 73-125 |        |     | 13 77-120 | 20  |
| Styrene                 | 100-42-5   | 1   | 0.7 ug/l  | 75-129 |        |     | 11 82-122 | 20  |
| 1,1,2,2-Tetrachloro     | 79-34-5    | 1   | 0.65 ug/l | 71-122 |        |     | 11 76-119 | 20  |
| Tetrachloroethene       | 127-18-4   | 1   | 0.9 ug/l  | 61-139 |        |     | 11 70-131 | 20  |
| Toluene                 | 108-88-3   | 1   | 0.53 ug/l | 60-135 |        |     | 10 80-120 | 20  |
| 1,2,3-Trichloro         | 87-61-6    | 1   | 0.5 ug/l  | 70-138 |        |     | 13 76-134 | 20  |
| 1,2,4-Trichloro         | 120-82-1   | 1   | 0.5 ug/l  | 72-137 |        |     | 13 79-132 | 20  |

Table 3

## VOCs

|                       |   |           |        |           |    |
|-----------------------|---|-----------|--------|-----------|----|
| 1,1,1-Trich 71-55-6   | 1 | 0.54 ug/l | 74-138 | 12 81-128 | 20 |
| 1,1,2-Trich 79-00-5   | 1 | 0.53 ug/l | 78-121 | 11 83-118 | 20 |
| Trichloroet 79-01-6   | 1 | 0.53 ug/l | 62-141 | 10 80-120 | 20 |
| Trichlorofl 75-69-4   | 2 | 0.84 ug/l | 57-149 | 14 64-136 | 20 |
| Vinyl chlor 75-01-4   | 1 | 0.79 ug/l | 43-146 | 15 51-135 | 20 |
| m,p-Xylene            | 1 | 0.78 ug/l | 50-144 | 20 80-120 | 20 |
| o-Xylene 95-47-6      | 1 | 0.59 ug/l | 63-134 | 10 80-120 | 20 |
| Xylene (tot 1330-20-7 | 1 | 0.59 ug/l | 56-139 | 20 80-120 | 20 |

|                        |  |  |                   |        |
|------------------------|--|--|-------------------|--------|
| Dibromofl 1868-53-7    |  |  | Surrogate Limits: | 80-120 |
| 1,2-Dichlor 17060-07-0 |  |  | Surrogate Limits: | 81-124 |
| Toluene-Di 2037-26-5   |  |  | Surrogate Limits: | 80-120 |
| 4-Bromofl 460-00-4     |  |  | Surrogate Limits: | 80-120 |

Table 3  
SVOCs

| Compound                    | CAS No.   | RL | MDL | Units     | Control Limits (%) Rev: 5/10/17 |     |           | DUP |
|-----------------------------|-----------|----|-----|-----------|---------------------------------|-----|-----------|-----|
|                             |           |    |     |           | MS/MSD                          | RPD | BS        |     |
| 2-Chlorophenol              | 95-57-8   |    | 5   | 0.82 ug/l | 36-113                          |     | 33 39-106 | 30  |
| 4-Chlorophenol              | 59-50-7   |    | 5   | 0.89 ug/l | 40-126                          |     | 29 45-118 | 30  |
| 2,4-Dichlorophenol          | 120-83-2  |    | 2   | 1.3 ug/l  | 40-119                          |     | 30 43-115 | 30  |
| 2,4-Dimethylphenol          | 105-67-9  |    | 5   | 2.4 ug/l  | 34-134                          |     | 30 38-125 | 30  |
| 2,4-Dinitrophenol           | 51-28-5   |    | 5   | 1.6 ug/l  | 22-157                          |     | 34 35-137 | 30  |
| 4,6-Dinitrophenol           | 534-52-1  |    | 5   | 1.3 ug/l  | 26-151                          |     | 37 45-134 | 30  |
| 2-Methylphenol              | 95-48-7   |    | 2   | 0.89 ug/l | 31-119                          |     | 32 34-106 | 30  |
| 3,4-Methylphenol            |           |    | 2   | 0.88 ug/l | 29-118                          |     | 31 31-110 | 30  |
| 2-Nitrophenol               | 88-75-5   |    | 5   | 0.96 ug/l | 38-123                          |     | 34 41-118 | 30  |
| 4-Nitrophenol               | 100-02-7  | 10 |     | 1.2 ug/l  | 10-161                          |     | 36 10-113 | 30  |
| Pentachlorophenol           | 87-86-5   |    | 4   | 1.4 ug/l  | 22-149                          |     | 36 21-134 | 30  |
| Phenol                      | 108-95-2  |    | 2   | 0.39 ug/l | 10-110                          |     | 35 10-110 | 30  |
| 2,3,4,6-Tetrachlorophenol   | 58-90-2   |    | 5   | 1.5 ug/l  | 43-131                          |     | 36 41-129 | 30  |
| 2,4,5-Trichlorophenol       | 95-95-4   |    | 5   | 1.3 ug/l  | 45-118                          |     | 30 45-117 | 30  |
| 2,4,6-Trichlorophenol       | 88-06-2   |    | 5   | 0.92 ug/l | 48-126                          |     | 31 47-125 | 30  |
| Acenaphthene                | 83-32-9   |    | 1   | 0.19 ug/l | 44-119                          |     | 28 40-114 | 30  |
| Acenaphthylene              | 208-96-8  |    | 1   | 0.14 ug/l | 40-115                          |     | 28 40-109 | 30  |
| Acetophenone                | 98-86-2   |    | 2   | 0.21 ug/l | 34-127                          |     | 32 43-112 | 30  |
| Anthracene                  | 120-12-7  |    | 1   | 0.21 ug/l | 44-120                          |     | 30 50-113 | 30  |
| Atrazine                    | 1912-24-9 |    | 2   | 0.45 ug/l | 31-149                          |     | 30 46-141 | 30  |
| Benzaldehyde                | 100-52-7  |    | 5   | 0.29 ug/l | 11-132                          |     | 37 27-116 | 30  |
| Benzo(a)anthracene          | 56-55-3   |    | 1   | 0.2 ug/l  | 48-116                          |     | 30 55-110 | 30  |
| Benzo(a)pyrene              | 50-32-8   |    | 1   | 0.21 ug/l | 43-120                          |     | 31 52-112 | 30  |
| Benzo(b)fluoranthene        | 205-99-2  |    | 1   | 0.21 ug/l | 42-123                          |     | 31 53-114 | 30  |
| Benzo(g,h,i)perylene        | 191-24-2  |    | 1   | 0.34 ug/l | 39-121                          |     | 32 46-115 | 30  |
| Benzo(k)fluoranthene        | 207-08-9  |    | 1   | 0.21 ug/l | 44-123                          |     | 31 55-115 | 30  |
| 4-Bromophenol               | 101-55-3  |    | 2   | 0.4 ug/l  | 47-127                          |     | 31 47-122 | 30  |
| Butyl benzene               | 85-68-7   |    | 2   | 0.46 ug/l | 41-135                          |     | 32 50-124 | 30  |
| 1,1'-Biphenyl               | 92-52-4   |    | 1   | 0.21 ug/l | 39-124                          |     | 29 42-114 | 30  |
| 2-Chloronaphthalene         | 91-58-7   |    | 2   | 0.24 ug/l | 37-120                          |     | 30 33-112 | 30  |
| 4-Chloronaphthalene         | 106-47-8  |    | 5   | 0.34 ug/l | 10-110                          |     | 49 17-87  | 30  |
| Carbazole                   | 86-74-8   |    | 1   | 0.23 ug/l | 46-127                          |     | 29 54-118 | 30  |
| Caprolactam                 | 105-60-2  |    | 2   | 0.65 ug/l | 10-110                          |     | 37 10-110 | 30  |
| Chrysene                    | 218-01-9  |    | 1   | 0.18 ug/l | 45-113                          |     | 30 52-107 | 30  |
| bis(2-Chlorophenyl) ether   | 111-91-1  |    | 2   | 0.28 ug/l | 33-122                          |     | 29 38-116 | 30  |
| bis(2-Chlorophenyl) sulfone | 111-44-4  |    | 2   | 0.25 ug/l | 29-132                          |     | 36 38-118 | 30  |
| 2,2'-Oxybisphenol A         | 108-60-1  |    | 2   | 0.4 ug/l  | 27-115                          |     | 34 29-108 | 30  |
| 4-Chlorophenol              | 7005-72-3 |    | 2   | 0.37 ug/l | 43-125                          |     | 30 40-122 | 30  |
| 2,4-Dinitrophenol           | 121-14-2  |    | 1   | 0.55 ug/l | 49-135                          |     | 31 54-129 | 30  |

Table 3

## SVOCs

|                       |    |           |        |           |    |
|-----------------------|----|-----------|--------|-----------|----|
| 2,6-Dinitro 606-20-2  | 1  | 0.48 ug/l | 50-135 | 32 53-131 | 30 |
| 3,3'-Dichloro 91-94-1 | 2  | 0.51 ug/l | 2-115  | 43 28-91  | 30 |
| 1,4-Dioxan 123-91-1   | 1  | 0.66 ug/l | 10-110 | 42 10-110 | 30 |
| Dibenzo(a, 53-70-3    | 1  | 0.33 ug/l | 44-121 | 32 51-117 | 30 |
| Dibenzofur 132-64-9   | 5  | 0.22 ug/l | 43-123 | 29 46-118 | 30 |
| Di-n-butyl 84-74-2    | 2  | 0.5 ug/l  | 46-133 | 30 54-124 | 30 |
| Di-n-octyl 117-84-0   | 2  | 0.23 ug/l | 31-147 | 32 41-137 | 30 |
| Diethyl ph 84-66-2    | 2  | 0.26 ug/l | 46-126 | 30 49-122 | 30 |
| Dimethyl p 131-11-3   | 2  | 0.22 ug/l | 49-120 | 29 51-118 | 30 |
| bis(2-Ethyl 117-81-7  | 2  | 1.7 ug/l  | 35-140 | 35 47-128 | 30 |
| Fluoranthene 206-44-0 | 1  | 0.17 ug/l | 48-122 | 30 54-118 | 30 |
| Fluorene 86-73-7      | 1  | 0.17 ug/l | 45-121 | 30 45-116 | 30 |
| Hexachloro 118-74-1   | 1  | 0.33 ug/l | 42-129 | 32 45-124 | 30 |
| Hexachloro 87-68-3    | 1  | 0.49 ug/l | 10-129 | 36 10-120 | 30 |
| Hexachloro 77-47-4    | 10 | 2.8 ug/l  | 10-111 | 40 10-110 | 30 |
| Hexachloro 67-72-1    | 2  | 0.39 ug/l | 12-116 | 37 11-110 | 30 |
| Indeno(1,2 193-39-5   | 1  | 0.33 ug/l | 39-129 | 33 45-123 | 30 |
| Isophorone 78-59-1    | 2  | 0.28 ug/l | 37-122 | 29 43-115 | 30 |
| 2-Methyln 91-57-6     | 1  | 0.21 ug/l | 33-118 | 31 37-111 | 30 |
| 2-Nitroanil 88-74-4   | 5  | 0.28 ug/l | 32-156 | 31 40-144 | 30 |
| 3-Nitroanil 99-09-2   | 5  | 0.39 ug/l | 11-114 | 41 31-104 | 30 |
| 4-Nitroanil 100-01-6  | 5  | 0.44 ug/l | 31-125 | 30 48-119 | 30 |
| Naphthalene 91-20-3   | 1  | 0.23 ug/l | 24-119 | 33 29-110 | 30 |
| Nitrobenzene 98-95-3  | 2  | 0.64 ug/l | 28-130 | 32 35-118 | 30 |
| N-Nitroso- 621-64-7   | 2  | 0.48 ug/l | 29-128 | 31 38-116 | 30 |
| N-Nitrosod 86-30-6    | 5  | 0.22 ug/l | 40-128 | 31 49-114 | 30 |
| Phenanthrene 85-01-8  | 1  | 0.18 ug/l | 41-128 | 30 49-116 | 30 |
| Pyrene 129-00-0       | 1  | 0.22 ug/l | 47-122 | 30 51-116 | 30 |
| 1,2,4,5-Tet 95-94-3   | 2  | 0.37 ug/l | 23-134 | 31 21-124 | 30 |

|                        |                   |        |
|------------------------|-------------------|--------|
| 2-Fluoroph 367-12-4    | Surrogate Limits: | 10-110 |
| Phenol-d5 4165-62-2    | Surrogate Limits: | 10-110 |
| 2-Chloroph             | Surrogate Limits: | 70-130 |
| 2,4,6-Tribr 118-79-6   | Surrogate Limits: | 36-151 |
| 1,2-Dichlor 2199-69-1  | Surrogate Limits: | 70-130 |
| Nitrobenzene 4165-60-0 | Surrogate Limits: | 34-128 |
| 2-Fluorobij 321-60-8   | Surrogate Limits: | 38-119 |
| Terphenyl- 1718-51-0   | Surrogate Limits: | 26-129 |

Table 3  
Pesticides

| Compound    | CAS No.    | RL    | MDL         | Units             | Control Limits (%) Rev: 3/30/17 |     |           |
|-------------|------------|-------|-------------|-------------------|---------------------------------|-----|-----------|
|             |            |       |             |                   | MS/MSD                          | RPD | BS        |
| Aldrin      | 309-00-2   | 0.005 | 0.0026 ug/l | 10-157            |                                 |     | 46 13-135 |
| alpha-BHC   | 319-84-6   | 0.005 | 0.0026 ug/l | 33-154            |                                 |     | 45 36-139 |
| beta-BHC    | 319-85-7   | 0.005 | 0.004 ug/l  | 36-154            |                                 |     | 45 44-136 |
| delta-BHC   | 319-86-8   | 0.005 | 0.0033 ug/l | 29-165            |                                 |     | 50 40-139 |
| gamma-BH    | 58-89-9    | 0.005 | 0.003 ug/l  | 33-154            |                                 |     | 43 43-136 |
| alpha-Chlo  | 5103-71-9  | 0.005 | 0.0025 ug/l | 26-158            |                                 |     | 44 32-140 |
| gamma-Ch    | 5103-74-2  | 0.005 | 0.0021 ug/l | 20-163            |                                 |     | 44 28-143 |
| Dieldrin    | 60-57-1    | 0.005 | 0.0038 ug/l | 24-165            |                                 |     | 44 39-142 |
| 4,4'-DDD    | 72-54-8    | 0.005 | 0.0029 ug/l | 27-157            |                                 |     | 45 36-142 |
| 4,4'-DDE    | 72-55-9    | 0.005 | 0.0025 ug/l | 13-164            |                                 |     | 43 27-140 |
| 4,4'-DDT    | 50-29-3    | 0.005 | 0.0034 ug/l | 11-169            |                                 |     | 44 30-144 |
| Endrin      | 72-20-8    | 0.005 | 0.003 ug/l  | 39-170            |                                 |     | 42 44-151 |
| Endosulfar  | 1031-07-8  | 0.005 | 0.0027 ug/l | 22-164            |                                 |     | 49 41-144 |
| Endrin alde | 7421-93-4  | 0.005 | 0.0034 ug/l | 21-176            |                                 |     | 48 42-144 |
| Endrin ket  | 53494-70-1 | 0.005 | 0.0031 ug/l | 33-166            |                                 |     | 45 41-149 |
| Endosulfar  | 959-98-8   | 0.005 | 0.0026 ug/l | 23-161            |                                 |     | 44 40-136 |
| Endosulfar  | 33213-65-1 | 0.005 | 0.0024 ug/l | 30-161            |                                 |     | 43 42-140 |
| Heptachlor  | 76-44-8    | 0.005 | 0.0022 ug/l | 10-158            |                                 |     | 47 11-140 |
| Heptachlor  | 1024-57-3  | 0.005 | 0.003 ug/l  | 29-163            |                                 |     | 43 41-138 |
| Methoxychl  | 72-43-5    | 0.01  | 0.0034 ug/l | 15-164            |                                 |     | 46 31-149 |
| Toxaphene   | 8001-35-2  | 0.13  | 0.08 ug/l   | 50-150            |                                 |     | 30 40-140 |
| Tetrachlor  | 877-09-8   |       |             | Surrogate Limits: |                                 |     | 13-153    |
| Decachlor   | 2051-24-3  |       |             | Surrogate Limits: |                                 |     | 10-138    |

Table 3  
PCBs

| Compound    | CAS No.    | RL   | MDL   | Units | Control Limits (%) Rev: 2/2/17 |     |           | DUP |
|-------------|------------|------|-------|-------|--------------------------------|-----|-----------|-----|
|             |            |      |       |       | MS/MSD                         | RPD | BS        |     |
| Aroclor 10  | 12674-11-7 | 0.25 | 0.098 | ug/l  | 18-187                         |     | 42 37-164 | 30  |
| Aroclor 12  | 11104-28-7 | 0.25 | 0.21  | ug/l  | 70-130                         |     | 50 70-130 | 30  |
| Aroclor 12  | 11141-16-9 | 0.25 | 0.13  | ug/l  | 70-130                         |     | 50 70-130 | 30  |
| Aroclor 12  | 53469-21-9 | 0.25 | 0.11  | ug/l  | 70-130                         |     | 50 70-130 | 30  |
| Aroclor 12  | 12672-29-0 | 0.25 | 0.063 | ug/l  | 70-130                         |     | 50 70-130 | 30  |
| Aroclor 12  | 11097-69-7 | 0.25 | 0.21  | ug/l  | 70-130                         |     | 50 70-130 | 30  |
| Aroclor 12  | 11096-82-9 | 0.25 | 0.076 | ug/l  | 10-185                         |     | 46 36-155 | 30  |
| Aroclor 12  | 11100-14-4 | 0.25 | 0.087 | ug/l  |                                |     | 50        | 30  |
| Aroclor 12  | 37324-23-9 | 0.25 | 0.097 | ug/l  |                                |     | 50        | 30  |
| Tetrachloro |            |      |       |       | Surrogate Limits:              |     | 11-166    |     |
| Decachloro  |            |      |       |       | Surrogate Limits:              |     | 10-150    |     |

9 compounds and 2 surrogates reported in list PCB11



**Table 3**  
**Metals**

| TEST | Method 200.7/6010 waters - normal RL in ug/l - ICP | Method 200.7/6010 waters - NJ RL in ug/l - ICP | Method 6010 waters - pooled MDL for SS ICP's in ug/l |
|------|----------------------------------------------------|------------------------------------------------|------------------------------------------------------|
| Al   | 200.0                                              |                                                | 45.84                                                |
| Sb   | 6.0                                                |                                                | 4.67                                                 |
| As   | 8.0                                                | 3.000                                          | 2.76                                                 |
| Ba   | 200.0                                              |                                                | 13.37                                                |
| Be   | 1.0                                                |                                                | 0.50                                                 |
| Cd   | 3.0                                                |                                                | 1.04                                                 |
| Ca   | 5000.0                                             |                                                | 99.20                                                |
| Cr   | 10.0                                               |                                                | 1.99                                                 |
| Co   | 50.0                                               |                                                | 2.57                                                 |
| Cu   | 10.0                                               |                                                | 5.85                                                 |
| Fe   | 100.0                                              |                                                | 32.11                                                |
| Pb   | 3.0                                                |                                                | 1.80                                                 |
| Mg   | 5000.0                                             |                                                | 139.77                                               |
| Mn   | 15.0                                               |                                                | 1.44                                                 |
| Ni   | 10.0                                               |                                                | 1.71                                                 |
| K    | 10000.0                                            |                                                | 200.30                                               |
| Se   | 10.0                                               |                                                | 4.94                                                 |
| Ag   | 10.0                                               |                                                | 1.88                                                 |
| Na   | 10000.0                                            |                                                | 568.60                                               |
| Tl   | 10.0                                               |                                                | 1.76                                                 |
| V    | 50.0                                               |                                                | 1.79                                                 |
| Zn   | 20.0                                               |                                                | 6.90                                                 |

| TEST                           | RL       | MDL    |
|--------------------------------|----------|--------|
| Hg AQ and TCLP Hg, SW846 7470A | 0.2 ug/l | 0.0952 |

## **SECTION 4**

### **SAMPLING PROGRAM**

#### **4.1 INTRODUCTION**

The sampling program will provide data concerning the presence and the nature and extent of soil, groundwater, soil-gas, and indoor air contamination. This section presents sample container preparation procedures, sample preservation procedures, sample holding times, and field QC sample requirements. Sample locations, and the number of environmental and QC samples to be taken are given in Table 4.1. The sampling procedures are presented in the Remedial Investigation Workplan.

#### **4.2 SAMPLE CONTAINER PREPARATION AND SAMPLE PRESERVATION**

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the NYSDEC. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be tagged and the appropriate preservatives will be added. The types of containers are listed in Tables 4.2 and 4.3.

Samples shall be preserved according to the preservation techniques given in Tables 4.2 and 4.3. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4°C with ice, and delivered to the laboratory within 24 hours of collection. Chain-of-custody procedures are described in Section 7.

Soil-gas and indoor air samples will be shipped to the laboratory at ambient temperatures with no preservative.

#### **4.3 SAMPLE HOLDING TIMES**

The sample holding times for organic and inorganic parameters are given in Tables 4.2 and 4.3 and must be in accordance with the NYSDEC requirements. The holding times must be strictly adhered to by the laboratory. Any holding time exceedances must be reported to WBA.

#### **4.4 FIELD QC SAMPLES**

To assess field sampling and decontamination performance, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates. Matrix

---

spike/matrix spike duplicates (MS/MSDs) will be completed by Accutest Laboratories and in accordance with Accutest's Quality System precision, accuracy, and completeness objectives. The blanks will include:

- a. Trip Blanks - A Trip Blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml VOA vial containing distilled, deionized water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples VOC analysis. The Trip Blank will be analyzed for VOCs to assess any contamination from sampling and transport, and internal laboratory procedures.
- b. Field Blanks - Field Blanks will be taken at a minimum frequency of one per 20 field samples per sample matrix, or one per day. Field blanks are used to determine the effectiveness of the decontamination procedures for sampling equipment. It is a sample of deionized, distilled water provided by the laboratory that has passed through a decontaminated bailer or other sampling apparatus. It is usually collected as a last step in the decontamination procedure, prior to taking an environmental sample. The field blank may be analyzed for all or some of the parameters of interest.

The duplicates will consist of:

- a. Coded Field Duplicate - To determine the representativeness of the sampling methods, coded field duplicates will be collected. The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.
- b. Matrix Spike/Matrix Spike Duplicate (MS/MSD) - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be completed by the analytical laboratory and/or taken at a frequency of one pair per 20 field samples and/or in accordance with Accutest's Quality System objectives.. These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Section 3 tables.

**TABLE 4.1**  
**SUMMARY OF SAMPLES AND ANALYSES**

| Matrix              | Parameter                                         | Analytical Method                                      | Field Samples |                 |                                  |           | QC Blanks  |             | Total |
|---------------------|---------------------------------------------------|--------------------------------------------------------|---------------|-----------------|----------------------------------|-----------|------------|-------------|-------|
|                     |                                                   |                                                        | Field Samples | Field Duplicate | MS/MSD <sup>(a)</sup><br>(Total) | Sub-Total | Trip Blank | Rinse Blank |       |
| Groundwater Samples | TCL VOCs, SVOCs, Pesticides, PCBs, and TAL Metals | EPA SW846 8260, 8270, 8081, 8082<br><br>EPA 200.7/SW84 | 3             | 1               | 1                                | 5         | 1          | 1           | 7     |
| Indoor air          | VOCs                                              | TO+15                                                  | 5             | 1               | 1                                | 7         |            |             | 7     |

- (a) Matrix spike / matrix spike duplicate for organic analyses; matrix spike and laboratory duplicate for inorganic analysis; to be completed by Accutest Laboratories.
- (b) The total number of soil samples will be determined in the field based on the scheduling and duration of the events.
- (c) The total number of groundwater samples will be determined in the field (if necessary).

Figure 4-1 shows the locations of the monitoring wells and 4-2 shows the indoor air sampling points listed in Table 4-1.

**TABLE 4.2**  
**WATER SAMPLE CONTAINERIZATION, PRESERVATION,**  
**AND HOLDING TIMES**

| <b>Analysis</b>                                | <b>Bottle Type</b>                  | <b>Preservation (a)</b>        | <b>Holding Time (b)</b> |
|------------------------------------------------|-------------------------------------|--------------------------------|-------------------------|
| Volatile Organic Method (8260)                 | 3-40 mL glass vial w/ Teflon septum | Cool to 4°C                    | 24 hrs-field/14 days    |
| Compounds (VOCs)                               |                                     |                                |                         |
| SVOCs 8270<br>1,4-Dioxane<br>(method 8270 SIM) | 2 x 1L unpreserved                  | Cool to 4°C                    | 7 days for extraction   |
| Pesticides 8081<br>PCBs 8082                   | 2 x 1L unpreserved                  | Cool to 4°C                    | 7 days for extraction   |
| TAL Metals<br>Months                           | 1-500 mL poly w/<br>Teflon septum   | HNO <sub>3</sub> , Cool to 4°C | 48 hrs-field/ 6         |
| PFAs<br>(Modified EPA method 537)              | 2x250 ml HPDE                       | Cool to 4°C                    | 14 days for extraction  |

(a) All samples to be preserved in ice during collection and transport.

(b) Days from time of sample receipt at the laboratory. Maximum field holding time for all samples is 48-hours.

**TABLE 4.3**  
**AIR SAMPLE CONTAINERIZATION, PRESERVATION,**  
**AND HOLDING TIMES**

| <b>Analysis</b> | <b>Bottle Type</b>             | <b>Preservation</b> | <b>Holding Time (a)</b> |
|-----------------|--------------------------------|---------------------|-------------------------|
| TO+15           | Stainless Steel Summa Canister | None                |                         |

(a) Days from time of sample receipt at the laboratory. Maximum field holding time for all samples is 48-hours.



### Legend

 Property Boundary

 Monitoring Wells

**FIGURE 4-1**  
**Monitoring Well Locations**

337 Berry St. & 99-105 South 5th St.  
 (Block 2443 / Lot 6, 37, 41)  
 Brooklyn, New York



**equity environmental engineering**

500 International Drive, Suite 150, Mount Olive, NJ 07828  
 Office: (973) 527-7451 / Fax: (973) 858-0280

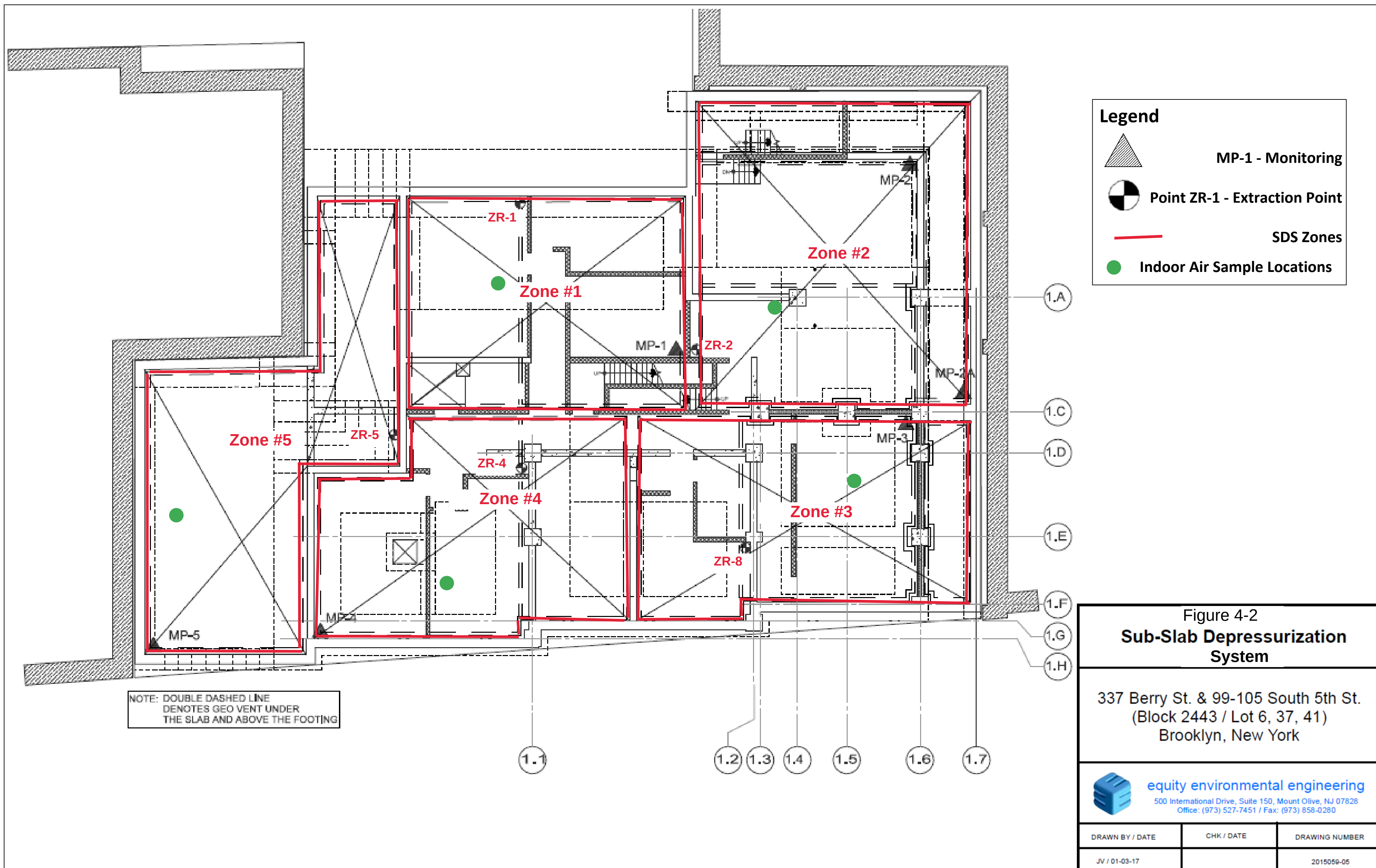
DRAWN BY / DATE

REV / DATE

DRAWING NUMBER

GB/10.2.18

2015059-04



## SECTION 5

### SAMPLE TRACKING AND CUSTODY

#### 5.1 INTRODUCTION

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the Chain-of-custody (COC) and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 5.1. A sample is considered to be in a person's custody if the sample is:

- In a person's possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with Custody Seals so that no one can tamper with it after having been in physical custody; or
- In a secured area which is restricted to authorized personnel.

#### 5.2 FIELD SAMPLE CUSTODY

A COC record (Figure 5.2 or similar) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected.

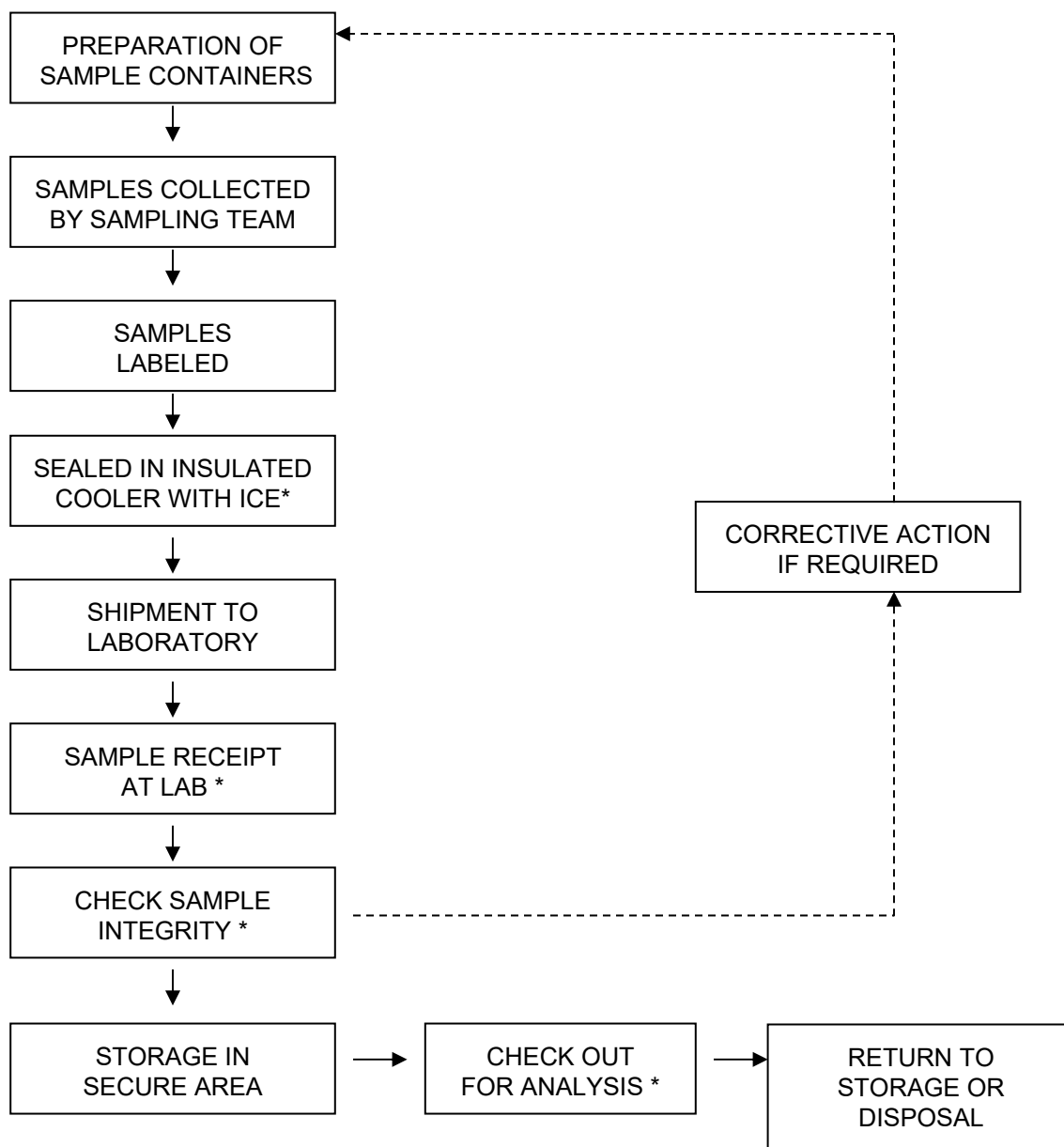
The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The REMARKS space on the COC is used to indicate if the sample is a matrix spike, matrix spike duplicate, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first RELINQUISHED BY space. The sampler will also write the method of shipment and the shipper air bill number of the top of the COC, if applicable. Mistakes will be crossed out with a single line in ink and initialed.



FIGURE 5.1

**SAMPLE CUSTODY**



\* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM



One copy of the COC is retained by sampling personnel (notations identifying blind duplicate samples will be added to this copy of the COC but not the others that will go to the laboratory) and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample will only be analyzed pending further investigation.

### **5.3 LABORATORY SAMPLE CUSTODY**

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.
- The samples will be stored in a secured area at a temperature of approximately 4 degrees Celsius until analyses commence.
- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

## **SECTION 6**

### **CALIBRATION PROCEDURES**

#### **6.1 FIELD INSTRUMENTS**

All field analytical equipment will be calibrated immediately prior to each day's use. The calibration procedures will conform to manufacturer's standard instructions and are described in the Field Sampling Plan. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the Field Team Leader. Copies of all the instrument manuals will be maintained on-site by the Field Team Leader.

Calibration procedures for instruments used for monitoring health and safety hazards (e.g., photoionization detector; dataRam dust monitors) are provided in the Health and Safety Plan.

#### **6.2 LABORATORY INSTRUMENTS**

The laboratory will follow all calibration procedures and schedules as specified in the sections of the USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods given in Section 7.

## **SECTION 7**

### **ANALYTICAL PROCEDURES**

Samples will be analyzed according to the USEPA SW-846 "Test Methods for Evaluating Solid Waste," February 2007, revision 6 and subsequent updates. The methods to be used for the laboratory analysis of soil, groundwater, and soil-gas/indoor air samples are referenced in Section 3 (Tables 3.1 through 3.4).

## **SECTION 8**

### **DATA REDUCTION, VALIDATION, AND REPORTING**

#### **8.1 INTRODUCTION**

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the Chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

#### **8.2 DATA REDUCTION**

One copy of the analytical data packages and an electronic disk deliverable (EDD) will be provided by the laboratory approximately 30 days after receipt of a complete sample delivery group. The Project Manager will immediately arrange for filing one package; a second copy, and the CD-ROM, may be used to generate summary tables. These tables will form the database for assessment of the site contamination condition (if present).

The electronic deliverable format required is a tab delimited text file with the fields and character lengths summarized in Table 8.1. EDDs will be processed regardless of the sampling date.

The Project Manager or Task Manager will maintain close contact with the laboratory QA reviewer to ensure all non-conformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review has been completed, the Project Manager may direct the Team Leaders or others to initiate and finalize the analytical data assessment.

**Table 8.1****Field and Character Lengths  
for Electronic Disk Deliverable**

| Description                     | Length | Format    |
|---------------------------------|--------|-----------|
| Site ID                         | 12     | Character |
| Site Name                       | 40     | Character |
| Initial Date Sampled            | 8      | Date      |
| Received at Lab Date            | 8      | Date      |
| Analysis Complete Date          | 8      | Date      |
| Laboratory                      | 30     | Character |
| Number of Samples               | 3      | Integer   |
| Contract                        | 6      | Character |
| Report Format                   | 10     | Character |
| Field ID (for each sample)      | 15     | Numeric   |
| Laboratory ID (for each sample) | 15     | Character |
| Date Sampled (for each sample)  | 8      | Date      |
| Matrix (for each sample)        | 10     | Character |

### 8.3 DATA VALIDATION

Laboratory data validation may be performed in accordance with the USEPA Region II validation guidelines for organic and inorganic data review. These validation guidelines are regional modifications to the National Functional Guidelines for organic and inorganic data review (USEPA 1994). Validation will include the following:

- Verification of 100% of all QC sample results (both qualitative and quantitative),
- Verification of the identification of 100% of all sample results (both positive hits and non-detects),
- Recalculation of 10% of all investigative sample results, and
- Data Validation/Usability Report
- A third party data validator will not be used on this project.

The determination to validate data will be made based on the presence of data anomalies, suspect data, or laboratory issues. A data validation report will be prepared and reviewed by the laboratory quality assurance officer (QAO) before issuance. The data validation report will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and COC procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method. A detailed assessment of each SDG will follow. For each of the organic analytical methods, the following will be assessed:

- Holding times;
- Instrument tuning;
- Instrument calibrations;
- Blank results;
- System monitoring compounds or surrogate recovery compounds (as applicable);
- Internal standard recovery results;
- MS and MSD results;
- Target compound identification;
- Chromatogram quality;
- Compound quantization and reported detection limits;
- System performance; and
- Results verification.

For each of the inorganic compounds, the following will be assessed:

- Holding times;



- Calibrations;
- Blank results;
- Interference check sample;
- Laboratory check samples;
- Duplicates;
- Matrix Spike;
- Furnace atomic absorption analysis QC;
- ICP serial dilutions; and
- Results verification and reported detection limits.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" - Not detected at given value;
- "UJ" - Estimated not detected at given value;
- "J" - Estimated value;
- "N" – Presumptive evidence at the value given;
- "R" - Result not useable; and
- No Flag - Result accepted without qualification.

## **SECTION 9**

### **INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY**

#### **9.1 QUALITY ASSURANCE BATCHING**

Each set of samples will be analyzed concurrently with calibration standards, method blanks, matrix spikes (MS), matrix spike duplicates (MSD) or laboratory duplicates, and QC check samples (if required by the protocol). MS/MSD samples will be designated by the laboratory and are not proposed to be collected in the field as part of this RIWP.

#### **9.2 CALIBRATION STANDARDS AND SURROGATES**

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

#### **9.3 ORGANIC BLANKS AND MATRIX SPIKE**

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives". The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing  $\text{KMnO}_4$ . The matrix spike is generated by addition of surrogate standard to each sample.

#### **9.4 TRIP AND FIELD BLANKS**

Trip blanks and field blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and to evaluate the possibility of atmospheric or cross contamination of the samples.

## **SECTION 10**

### **QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS**

#### **10.1 INTRODUCTION**

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the project Quality Assurance Officer (QAO). These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

#### **10.2 SYSTEM AUDITS**

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or if the Project Manager requests additional audits may occur.

#### **10.3 PERFORMANCE AUDITS**

The laboratory may be required to conduct an analysis of Performance Evaluation (PE) samples or provide proof that Performance Evaluation samples submitted by USEPA or a state agency have been analyzed within the past twelve months.

#### **10.4 FORMAL AUDITS**

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements have been developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the

involved management. Non-compliance occasions will be logged, and documented through audit findings which are attached to and are a part of the integral audit report. These audit finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions are approved by the QAO prior to issue. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

## **SECTION 11**

### **PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES**

#### **11.1 PREVENTIVE MAINTENANCE PROCEDURES**

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

#### **11.2 SCHEDULES**

Written procedures will establish the schedule for servicing critical items in order to minimize the downtime of the measurement system. The laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

#### **11.3 RECORDS**

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

## **SECTION 12**

### **CORRECTIVE ACTION**

#### **12.1 INTRODUCTION**

The following procedures have been established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

#### **12.2 PROCEDURE DESCRIPTION**

When a significant condition adverse to quality is noted at site, laboratory, or subcontractor location, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and involved contractor management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NJDEP.

Project management and staff such as field investigation teams, remedial response planning personnel, and laboratory groups, monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites, laboratories, or contractor locations. Activities, or documents ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Task Manager.

---

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 12.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

**FIGURE 12.1**

| <b>CORRECTIVE ACTION REQUEST</b>                                                                                                                                                                                                                                                       |               |                   |               |                   |               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------|---------------|-------------------|---------------|
| Number: _____                                                                                                                                                                                                                                                                          |               | Date: _____       |               |                   |               |
| TO: _____<br>You are hereby requested to take corrective actions indicated below and as otherwise determined by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written response is to be returned to the project quality assurance manager by _____ |               |                   |               |                   |               |
| CONDITION:                                                                                                                                                                                                                                                                             |               |                   |               |                   |               |
| REFERENCE DOCUMENTS:                                                                                                                                                                                                                                                                   |               |                   |               |                   |               |
| RECOMMENDED CORRECTIVE ACTIONS:                                                                                                                                                                                                                                                        |               |                   |               |                   |               |
| _____<br>Originator                                                                                                                                                                                                                                                                    | _____<br>Date | _____<br>Approval | _____<br>Date | _____<br>Approval | _____<br>Date |
| RESPONSE                                                                                                                                                                                                                                                                               |               |                   |               |                   |               |
| CAUSE OF CONDITION                                                                                                                                                                                                                                                                     |               |                   |               |                   |               |
| CORRECTIVE ACTION<br><br>(A) RESOLUTION<br><br>(B) PREVENTION<br><br>(C) AFFECTED DOCUMENTS                                                                                                                                                                                            |               |                   |               |                   |               |
| C.A. FOLLOWUP:                                                                                                                                                                                                                                                                         |               |                   |               |                   |               |
| CORRECTIVE ACTION VERIFIED BY: _____ DATE: _____                                                                                                                                                                                                                                       |               |                   |               |                   |               |



## SECTION 13

### REFERENCES

- NYSDEC 2010. DER-10, "*Technical Guidance for Site Investigation and Remediation*" revised 2017. New York State Department of Environmental Conservation.
- NYSDOH 2006. *Guidance for Evaluating Soil Vapor Intrusion in the State of New York*. New York State Department of Health.
- USEPA, 2002. "Guidance for Quality Assurance Project Plans," dated December 2002. U.S. Environmental Protection Agency, Washington, D.C.
- USEPA, 2007. SW-846 "*Test Method for Evaluating Solid Waste*," dated February 2007. U.S. Environmental Protection Agency, Washington, D.C.
- Taylor, J. K., 1987. "*Quality Assurance of Chemical Measurements*." Lewis Publishers, Inc., Chelsea, Michigan
- USEPA, 1987. "*Data Quality Objectives for Remedial Response Actions Activities: Development Process, EPA/540/G-87/003, OSWER Directive 9355.0-7*." U.S. Environmental Protection Agency, Washington, D.C.
- USEPA, 1992a. "*CLP Organics Data Review and Preliminary Review. SOP No. HW-6, Revision #8*," dated January 1992. USEPA Region II.
- USEPA, 1992b. "*Evaluation of Metals Data for the Contract Laboratory Program (CLP) based on SOW 3/90. SOP No. HW-2, Revision XI*," dated January 1992. USEPA Region II.

## **APPENDIX I**

### **SITE MANAGEMENT FORM**

| Type                          | Inspection Task                       | Status | Condition | Date Completed | Initials | Remarks |
|-------------------------------|---------------------------------------|--------|-----------|----------------|----------|---------|
| Infrastructure                | Building                              |        |           |                |          |         |
|                               | Basement Slab                         |        |           |                |          |         |
|                               | Pavement                              |        |           |                |          |         |
|                               | Landscaping                           |        |           |                |          |         |
|                               | New Structures                        |        |           |                |          |         |
|                               | Monitoring Wells                      |        |           |                |          |         |
|                               | SSDS                                  |        |           |                |          |         |
|                               | SVE                                   |        |           |                |          |         |
| Physical                      | Site Fences/Security                  |        |           |                |          |         |
|                               | Topography                            |        |           |                |          |         |
|                               | Surface Drainage                      |        |           |                |          |         |
|                               | Cover System                          |        |           |                |          |         |
|                               | Vegetation                            |        |           |                |          |         |
| Contamination                 | Odors                                 |        |           |                |          |         |
|                               | Staining                              |        |           |                |          |         |
|                               | Sheens                                |        |           |                |          |         |
| Property Owner Representative | Interview                             |        |           |                |          |         |
|                               | New                                   |        |           |                |          |         |
| Inspection Acknowledgement    | Signature/Date_____ Representing_____ |        |           |                |          |         |

Notes

Status - Modified/Unchanged

Condition - unchanged/Deteriorated

Interview - work completed during the previous year and future plans

**Summary of Green Remediation Metrics for Site Management**

Site Name: \_\_\_\_\_ Site Code: \_\_\_\_\_  
 Address: \_\_\_\_\_ City: \_\_\_\_\_  
 State: \_\_\_\_\_ Zip Code: \_\_\_\_\_ County: \_\_\_\_\_

**Initial Report Period (Start Date of period covered by the Initial Report submittal)**

Start Date: \_\_\_\_\_

**Current Reporting Period**

Reporting Period From: \_\_\_\_\_ To: \_\_\_\_\_

**Contact Information**

Preparer's Name: \_\_\_\_\_ Phone No.: \_\_\_\_\_  
 Preparer's Affiliation: \_\_\_\_\_

**I. Energy Usage:** Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

|                                                                    | <b>Current Reporting Period</b> | <b>Total to Date</b> |
|--------------------------------------------------------------------|---------------------------------|----------------------|
| Fuel Type 1 (e.g. natural gas (cf))                                |                                 |                      |
| Fuel Type 2 (e.g. fuel oil, propane (gals))                        |                                 |                      |
| Electricity (kWh)                                                  |                                 |                      |
| <b>Of that Electric usage, provide quantity:</b>                   |                                 |                      |
| Derived from renewable sources (e.g. solar, wind)                  |                                 |                      |
| <b>Other energy sources</b> (e.g. geothermal, solar thermal (Btu)) |                                 |                      |

*Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.*

**II. Solid Waste Generation:** Quantify the management of solid waste generated on-site.

|                                                   | <b>Current Reporting Period (tons)</b> | <b>Total to Date (tons)</b> |
|---------------------------------------------------|----------------------------------------|-----------------------------|
| <b>Total waste generated on-site</b>              |                                        |                             |
| OM&M generated waste                              |                                        |                             |
| <b>Of that total amount, provide quantity:</b>    |                                        |                             |
| Transported off-site to landfills                 |                                        |                             |
| Transported off-site to other disposal facilities |                                        |                             |
| Transported off-site for recycling/reuse          |                                        |                             |
| Reused on-site                                    |                                        |                             |

*Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.*

**III. Transportation/Shipping:** Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

|                                     | <b>Current Reporting Period (miles)</b> | <b>Total to Date (miles)</b> |
|-------------------------------------|-----------------------------------------|------------------------------|
| Standby Engineer/Contractor         |                                         |                              |
| Laboratory Courier/Delivery Service |                                         |                              |
| Waste Removal/Hauling               |                                         |                              |

*Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.*

**IV. Water Usage:** Quantify the volume of water used on-site from various sources.

|                                                | <b>Current Reporting Period (gallons)</b> | <b>Total to Date (gallons)</b> |
|------------------------------------------------|-------------------------------------------|--------------------------------|
| Total quantity of water used on-site           |                                           |                                |
| <b>Of that total amount, provide quantity:</b> |                                           |                                |
| Public potable water supply usage              |                                           |                                |
| Surface water usage                            |                                           |                                |
| On-site groundwater usage                      |                                           |                                |
| Collected or diverted storm water usage        |                                           |                                |

*Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.*

**V. Land Use and Ecosystems:** Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

|                | <b>Current Reporting Period (acres)</b> | <b>Total to Date (acres)</b> |
|----------------|-----------------------------------------|------------------------------|
| Land disturbed |                                         |                              |
| Land restored  |                                         |                              |

*Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.*

|                                                                                                         |
|---------------------------------------------------------------------------------------------------------|
| <b>Description of green remediation programs reported above</b><br>(Attach additional sheets if needed) |
| Energy Usage:                                                                                           |
| Waste Generation:                                                                                       |
| Transportation/Shipping:                                                                                |
| Water usage:                                                                                            |
| Land Use and Ecosystems:                                                                                |
| Other:                                                                                                  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CERTIFICATION BY CONTRACTOR</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>I, _____ (Name) do hereby certify that I am _____ (Title) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application.</p> |
| <div style="display: flex; justify-content: space-between;"> <div>_____</div> <div>_____</div> </div> <div style="display: flex; justify-content: space-between;"> <div><b>Date</b></div> <div><b>Contractor</b></div> </div>                                                                                                                                                                                                                                                                                                      |

## **APPENDIX J**

### **FIELD SAMPLING PLAN**

**Field Sampling Plan**  
**Williamsburg Bridgeview Apartments**  
**95-105 South 5<sup>th</sup> Street**  
**Brooklyn, NY**

**NYSDEC Site Number: C224233**

Prepared for:

LPC Development Group, LLC  
456 E173rd St.  
Bronx, NY 10457

Prepared by:

Equity Environmental Engineering LLC  
500 International Drive  
Mt. Olive, NJ 07828

**October 2018**



## Table of Contents

|            |                                                                                                |            |
|------------|------------------------------------------------------------------------------------------------|------------|
| <b>1.0</b> | <b>Introduction .....</b>                                                                      | <b>1-1</b> |
| 1.1        | Project Description.....                                                                       | 1-1        |
| 1.2        | Scope of Work .....                                                                            | 1-1        |
| <b>2.0</b> | <b>General Field Guidelines.....</b>                                                           | <b>2-1</b> |
| 2.1        | Site Hazards .....                                                                             | 2-1        |
| 2.2        | Underground Utilities .....                                                                    | 2-1        |
| 2.3        | Field Log Books.....                                                                           | 2-1        |
| <b>3.0</b> | <b>Field Equipment Decontamination and Management of Investigation-Derived Residuals .....</b> | <b>3-1</b> |
| 3.1        | Decontamination Area .....                                                                     | 3-1        |
| 3.2        | Equipment Decontamination.....                                                                 | 3-1        |
| 3.2.1      | Sampling Equipment Decontamination.....                                                        | 3-1        |
| 3.3        | Management of Investigation-Derived Residuals .....                                            | 3-2        |
| 3.3.1      | Decontamination Fluids .....                                                                   | 3-2        |
| 3.3.2      | Drill Cuttings .....                                                                           | 3-2        |
| 3.3.3      | Development and Purge Water .....                                                              | 3-2        |
| 3.3.4      | Personal Protective Equipment .....                                                            | 3-2        |
| 3.3.5      | Dedicated Sampling Equipment .....                                                             | 3-2        |
| <b>4.0</b> | <b>Well Installation Procedures .....</b>                                                      | <b>4-1</b> |
| 4.1        | Introduction .....                                                                             | 4-1        |
| 4.2        | Monitoring Well Installation and Development.....                                              | 4-3        |
| 4.2.1      | Overburden Monitoring Well Installation.....                                                   | 4-3        |
| 4.2.2      | Monitoring Well Development.....                                                               | 4-4        |
| <b>5.0</b> | <b>Groundwater Sampling Procedures.....</b>                                                    | <b>5-1</b> |
| 5.1        | Introduction .....                                                                             | 5-1        |
| 5.2        | Groundwater Sampling.....                                                                      | 5-1        |
| 5.2.1      | Required Equipment and Supplies.....                                                           | 5-1        |
| 5.2.2      | Groundwater Sampling Method.....                                                               | 5-2        |

|                                                                     |            |
|---------------------------------------------------------------------|------------|
| <b>6.0 Indoor Air Sampling .....</b>                                | <b>6-1</b> |
| <b>7.0 Air monitoring .....</b>                                     | <b>7-1</b> |
| 7.1 Introduction.....                                               | 7-1        |
| 7.2 Breathing Zone Air Monitoring During Drilling and Sampling..... | 7-1        |
| 7.3 Community Air Monitoring .....                                  | 7-1        |
| <b>8.0 Field Instruments and Calibration.....</b>                   | <b>8-1</b> |
| 8.1 Portable Photo-Ionization Detector (PID).....                   | 8-1        |
| 8.2 Multi-Parameter Groundwater Meter .....                         | 8-1        |
| <b>9.0 Analytical Program.....</b>                                  | <b>9-1</b> |

## **List of Figures**

1. Site Location Map
2. Site Map
3. Soil Boring Log
4. Monitoring Well Construction Log
5. Field Data Sheet
6. Indoor Air Building Inventory

## **1.0 Introduction**

This Field Sampling Plan (FSP) present the methods and procedures to be used for any ground intrusive, maintenance, and monitoring activities covered under the Williamsburg Bridgeview Apartment Site Management Plan.

### **1.1 Project Description**

The site is located in Brooklyn, Kings County, New York and is identified as Block 2443 and Lot 6 (formerly lots 6, 37, and 41) on the Williamsburg Tax Map. The site is an approximately one-third-acre area and is bounded by Berry Street to the north, residential property to the east, commercial property to the west, and South 5th Street to the south (see Figures 1 and 2).

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial and residential mixed use properties. The properties immediately south of the entire Site include South 5<sup>th</sup> Street and the Williamsburg Bridge underpass; the properties immediately north of the Site include residential properties; the properties immediately east of the Site include commercial and residential properties; and the properties to the west of the Site include residential properties.

The Site has been redeveloped and what once was a vacant warehouse and undeveloped land there is now an 11-story residential building and ancillary parking.

### **1.1 Scope of Work**

The scope of work at the Site covered under this FSP includes.

- Monitoring well installation and development
- Groundwater sampling and analysis
- Indoor air and ambient air sampling and analysis
- Investigation-derived waste management
- Data validation, evaluation, and reporting
- Community air monitoring (addressed in a separate appendix)

This FSP will be modified for specialized work if necessary. Any modification to the FSAP will require approval in writing from the DEC. The property owner or its representative must notify National Grid of any scheduled ground intrusive work at least 15 days prior to the start of field activity.

## **2.0 General Field Guidelines**

### **2.1 Site Hazards**

Potential Site surface hazards, such as sharp objects, overhead power lines, energized areas, vehicular traffic, and building hazards will be identified prior to initiation of the fieldwork. Generally, potential hazards at the project site will be identified during a project site reconnaissance by the project team on the first day of any field activity. Additional safety measures to be undertaken for the work performed during the investigation are addressed in the Health and Safety Plan [(HASP), Appendix F of the SMP].

### **2.2 Underground Utilities**

Underground utilities, including electric lines, gas lines, water lines, storm and sanitary sewers, and communication lines will be identified prior to initiation of any subsurface work. Underground utility location will be accomplished as follows:

- All work areas will be flagged or marked out with white paint.
- Dig Safely of New York (800) 272-4480 will be contacted to initiate the locating activities. New York State law requires that Dig Safely of New York be notified at least three working days, and not more than 10 working days, before subsurface work is conducted.
- Companies with subsurface utilities present will locate and mark out all subsurface utility lines.
- Geophysical methods may be used to further evaluate the potential presence of underground utilities in the area of each proposed investigation location.
- Subsurface investigation locations may be hand cleared to five feet below ground surface (bgs) prior to advancing borings with mechanized equipment.

### **2.3 Field Log Books**

All field activities will be carefully documented in field log books. Entries will be of sufficient detail that a complete daily record of significant events, observations, and measurements is developed. The field log book will provide a legal record of the activities conducted at the site. Accordingly:

- Field books will be assigned a unique identification number.
- Field books will be bound with consecutively numbered pages.
- Field books will be controlled by the Site Manager while fieldwork is in progress.
- Entries will be written with waterproof ink.
- Entries will be signed and dated at the conclusion of each day of fieldwork.
- Erroneous entries made while fieldwork is in progress will be corrected by the field person that made the entries. Corrections will be made by drawing a line through the error, entering the correct information, and initialing the correction.
- Corrections necessary after departing the field will be made by the person who entered the original information. Corrections will be made by drawing a line through the error, entering the correct information, and initialing and dating the time of the correction.

At a minimum, daily field book entries will include the following information:

- Location of field activity;
- Date and time of entry;

- Names and titles of field team members on site and site contacts;
- Names, titles of any site visitors, as well as the date and time entering and leaving the site;
- Weather information, for example: temperature, cloud coverage, wind speed, and direction;
- Purpose of field activity;
- A detailed description of the fieldwork conducted;
- Sample media (soil, sediment, groundwater, etc.);
- Sample collection method;
- Number and volume of sample(s) taken;
- Description of sampling point(s);
- Volume of groundwater removed before sampling;
- Preservatives used;
- Analytical parameters;
- Date and time of collection;
- Sample identification number(s);
- Sample distribution (e.g., laboratory);
- Field observations;
- All field measurements made, such as volatile organic compounds (VOCs) using a PID, pH, temperature, conductivity, water level, etc.;
- References for all maps and photographs of the sampling site(s); and
- Information pertaining to sample documentation such as:
  - Bottle lot numbers;
  - Dates and method of sample shipments;
  - Chain-of-custody (COC) record numbers; and
  - Federal Express air bill number.

### **3.0 Field Equipment Decontamination and Management of Investigation-Derived Residuals**

#### **3.1 Decontamination Area**

A temporary decontamination area lined with polyethylene sheeting will be constructed on the project site for use during decontamination of the drilling equipment. Water collected from the decontamination of activities will be collected in 55-gallon drums or a bulk tank and managed as described in Section 3.3.

#### **3.2 Equipment Decontamination**

The following procedures will be used to decontaminate equipment used during any activities.

- All drilling equipment including the augers, bits, rods, tools, and tremie pipes will be cleaned with a high-pressure, hot water pressure washing unit between locations and following completion of activities.
- Tools, drill rods, and augers will be placed on something other than the ground following pressure washing.
- The back of the drill rig and all tools, augers, and rods will be decontaminated at the completion of the work and prior to leaving the project site.

##### **3.2.1 Sampling Equipment Decontamination**

###### **Suggested Materials:**

- Potable water;
- Phosphate-free detergent (such as Alconox™);
- Distilled water;
- Aluminum foil;
- Plastic/polyethylene sheeting;
- Plastic buckets and brushes; and
- Personal protective equipment (PPE) in accordance with the HASP.

###### **Procedures:**

- Prior to sampling, all non-dedicated sampling equipment (bowls, spoons, interface probes, etc.) will be washed with potable water and a phosphate-free detergent (such as Alconox™). Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, etc.
- The sampling equipment will then be rinsed with potable water followed by a de-ionized water rinse.
- Between rinses, equipment will be placed on polyethylene sheets, if necessary. At no time will washed equipment be placed directly on the ground.
- Equipment will be wrapped in polyethylene plastic for storage or transportation from the designated decontamination area to the sampling location.

### **3.3 Management of Investigation-Derived Residuals**

#### **3.3.1 Decontamination Fluids**

Hot water pressure wash and decontamination fluids will be collected in 55-gallon drums or a bulk tank. The storage drums or tank will be labelled as “pending analysis – investigation-derived residual decon water” and temporarily stored in a plastic-lined containment area pending characterization and proper disposal.

#### **3.3.2 Drill Cuttings**

Drill cuttings will be contained in 55-gallon drums. The drums will be labelled as “pending analysis – investigation-derived residual – soil from drill cuttings” and temporarily stored in a plastic-lined containment area pending characterization and proper disposal.

#### **3.3.3 Development and Purge Water**

All development and purge water will be contained in 55-gallon drums or a bulk tank. The drums or tank will be labelled as “pending analysis - investigation derived residual development and purge water” and temporarily stored in a plastic-lined containment area pending characterization and proper disposal.

#### **3.3.4 Personal Protective Equipment**

All PPE will be placed in thick mil plastic bags for proper disposal.

#### **3.3.5 Dedicated Sampling Equipment**

All dedicated groundwater sampling equipment will be placed in thick mil plastic bags or 55-gallon drums for disposal. No sampling material will be left in the well for future sampling events.



## **4.0 Soil Sampling and Well Installation Procedures**

### **4.1 Introduction**

Surface and subsurface activities to be conducted at the Site may consist of utility work; excavation; the installation of groundwater monitoring wells and soil vapor intrusion and indoor air sampling. These activities will require the use of the following equipment and material:

- Field book;
- Project plans;
- PPE in accordance with the HASP;
- Tape measure;
- Decontamination supplies;
- Water level indicator;
- Electronic oil/water interface probe
- Stainless steel bailers;
- Submersible electric pump for well development (the pump will be NYSDEC approved);
- Horiba multi-meter for field parameters (well development);
- PID with a 10.2 or 10.6 eV lamp;
- Camera;
- Clear tape, duct tape;
- Laboratory sample bottles;
- Coolers and ice; and

Procedures for these activities are described in the following sections.

### **4.2 Excavation**

Excavation activities, if any, will be dictated by the Contractor hired to conduct the work and will follow the Excavation Work Plan included as Appendix E of the SMP. During field activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring and odor mitigation (if necessary) will be conducted in accordance with the Community Air Monitoring Project (CAMP) and HASP. Excavation materials will be photographed and logged for future reference. Material removed from the excavation will be placed on polyethylene sheeting. The location and size of the excavation will be measured and described in the field logbook.

Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils may be placed back in the excavation. At a minimum, the top 2 feet of backfilled soil will be visually clean. The excavation will be backfilled as soon as possible after completion and in general prior to the cessation of activities at the end of the day. If excavation resulted in removal of any remaining contamination, a demarcation layer as detailed in Appendix E of the SMP will be placed over the surface prior to backfilling. Following restoration of the excavation, the excavation will be staked/marked to facilitate subsequent location by surveying crews.

#### **4.2.1 Soil Borings**

Soil borings, if any, will be advanced with the appropriate drilling equipment for the work. Typically a direct-push (Geoprobe™) drilling rig equipped with 4-foot long, 2-inch diameter Macro-Core™ samplers will be used. A sonic drill rig may be used based on the depth of the boring based on previous onsite work. All drilling equipment will be decontaminated between each boring in accordance with methods specified in Section 3.2.

All locations will be properly abandoned following the collection of samples. Boreholes for the direct-push borings will be filled with the soil cuttings and topped off with bentonite chips if necessary. The borings will be filled using a cement/bentonite grout mixture with the following specifications:

- Bentonite will be powdered sodium montmorillonite furnished in moisture resistant sacks without additives.
- Cement shall be a low-alkaline Portland cement, Type I in conformance with ASTM C-150 and without additives.
- The cement/bentonite grout mixture shall be to the following proportion:
  - Three sacks (94 pounds) of Type I Portland cement;
  - 14 pounds of granular bentonite (5% mix); and
  - 25 gallons of water.

The cement will be mechanically mixed, above ground, with water from a potable water source. Bentonite will be added to ensure a lump-free consistency. The mixture will be pumped through a tremie pipe as the drill is being withdrawn.

#### **4.2.2 Geologic Logging Methods**

The field technician will log borehole geology and headspace measurements, and any other observations (e.g., odors, non-aqueous phase liquid (NAPL), soil staining, etc.), in the field book and the soil boring log. Soil samples retrieved from the borehole will be visually described for: 1) percent recovery, 2) soil type, 3) color, 4) moisture content, 5) texture, 6) grain size and shape, 7) consistency, 8) visible evidence of staining or other hydrocarbon-related impacts, and 9) any other relevant observations. The descriptions will be in accordance with the Unified Soil Classification System (USCS) and the American Society for Testing and Materials (ASTM) guidelines.

#### **4.2.3 Collection of Samples**

The number and frequency of samples to be collected from each boring and the associated analytical parameters will be based on the field activity. The sample locations, descriptions, and depths will be recorded on the bore logs in the field book.

Samples for laboratory analyses will be collected directly from the sampling device and placed into appropriate containers for all grab sample analyses or homogenized for composite samples (except for VOC analyses); and compacted to minimize headspace and pore space. Dedicated sampling equipment will be used for soil sampling. Soil remaining after completion of sample description, collection, and field screening will be properly disposed.

The sample containers will be labelled, placed in a laboratory-supplied cooler, and packed with ice. The coolers will then be shipped to the laboratory for analysis. COC procedures will be followed as outlined in Appendix H Quality Assurance Project Plan (QAPP) of the SMP. If there is a delay of

sample shipment due to insufficient samples to warrant overnight delivery, the samples will be stored in a cool, secure place with sufficient ice to maintain a temperature of 4° C.

#### **4.3 Monitoring Well Installation and Development**

The following methods will be used for drilling, installing, and developing the monitoring wells. Figure 3 and 4 illustrates the construction details for a typical overburden soil boring and monitoring well respectively. Specific details regarding the depth and anticipated screened interval of proposed monitoring wells is provided in the SMP. In general, monitoring wells will be installed according to the following specifications:

- The monitoring well borings will be advanced using a sonic drill rig
- Wells will be constructed with 2-inch ID, threaded, flush-joint, Schedule 40 PVC casings and screens.
- Screens will be 10-feet long with 0.01-inch slot openings (or 0.02-inch, if NAPL present) with a 2-foot DNAPL sump at the base. Alternative screen lengths up to 20 feet long may be used at the discretion of the field geologist and with the approval of DEC, based on site conditions.
- The annulus around the screens will be backfilled with clean silica sand having appropriate size (e.g., Morie No. 1) to a minimum height of 2 feet above the top of the screen.

A bentonite chip seal with a minimum thickness of 2 feet will be placed above the sand pack. The bentonite seal will be hydrated with clean, potable water before placement of grout above the seal layer.

- The remainder of the annular space will be filled with cement-bentonite grout to ground surface. The grout will be allowed to set for a minimum of 24 hours before wells are developed.
- Each monitoring well will be a flush-mounted installation with a locking cap.
- The concrete seal or pad will be sloped to channel water away from the well, and be deep enough to remain stable during freezing and thawing of the ground.
- The top of the PVC well casing and ground surface will be marked and surveyed to 0.01 foot, and the elevation will be determined relative to a fixed benchmark or datum.
- The measuring point on all wells will be on the innermost PVC casing.
- Monitoring well construction details will be recorded in the field book and on the Construction Log shown in Appendix D of the SMP.
- If commercially available nested wells are considered to sample multiple aquifer depth zones in the same borehole, they will be discussed with DEC prior to installation.

##### **4.3.2 Monitoring Well Development**

- After a minimum of 24 hours after installation, the monitoring wells will be developed by surging and pumping. Surging will be performed periodically, across the lengths of screen in 2-foot increments prior to, at interim periods of pumping, and immediately before the final pumping. Pumping methods may include using a centrifugal, submersible, or peristaltic pump and dedicated polyethylene tubing.
- Water levels will be measured in each well to the nearest 0.01 foot prior to development.

- The wells will be developed until the water in the well is reasonably free of visible sediment (50 NTU if possible or until pH, temperature, and specific conductivity stabilize). A multi-meter probe will be used for all field parameter measurements.
- Development water will be contained in and properly disposed of.

Following development, wells will be allowed to recover for at least 14 days before groundwater is purged and sampled. All monitoring well development will be performed or overseen by a field geologist and recorded in the field book.

## **5.0 Groundwater Sampling Procedures**

### **5.1 Introduction**

Procedures for collecting groundwater samples of groundwater are described in this section. Groundwater samples will be collected using low-flow, low-stress purge and sampling methods. The NYSDEC approved sampling protocol and appropriate equipment for PFAs will be followed/used for groundwater sampling.

### **5.2 Groundwater Sampling**

The following method will be used to collect groundwater samples from monitoring wells.

#### **5.2.1 Required Equipment and Supplies**

- Field book
- Project plans
- PPE in accordance with the HASP
- Electronic oil/water interface probe
- Stainless steel bailers and low-flow sampling pump
- Polypropylene rope
- Multi-meter for all filed parameters
- Flow-through cell
- Decontamination supplies
- Peristaltic or NYSDEC approved submersible pump capable of achieving low-flow rates (i.e., 0.5 liters per minute or less)
- HDPE plastic tubing
- Plastic sheeting
- PID
- Clear tape, duct tape
- Coolers and ice
- Laboratory sample bottles

#### **5.2.2 Groundwater Sampling Method**

##### **5.2.2.1 Purging**

- Prior to sampling, the static water level and thickness of any light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL) will be measured to the nearest 0.01 foot from the surveyed well elevation mark on the top of the PVC casing with a decontaminated oil/water interface probe. NAPL thickness will be confirmed using a clear bailer or a weighted string. The measurement will be recorded in the field book.
- The probe will be decontaminated between uses.
- Groundwater from the well will be purged until field parameters stabilize, up to three well volumes are removed, or 1 hour of continuous purging is performed. Field parameters are considered to be stable when three consecutive readings are within the stabilization criteria for that parameter. The stabilization criteria are as follows: 10% or below 10 NTUs for

turbidity, 3% for conductivity and temperature, 0.1 unit for pH, and 10 mV for ORP. Purging will be conducted using the low-flow sampling technique specified by the United States Environmental Protection Agency (USEPA) Region 1 in its guidance document entitled “Low-Stress (low flow) Purging and Sampling for the Collection of Groundwater Samples from Monitoring Wells”.

- The flow rate measurement will be approximately 0.5 liter per minute or less.
- If a well goes dry before the required volumes are removed, it will be allowed to recover, purged a second time until dry or the required parameters are met, and sampled when it recovers sufficiently, in accordance with low-flow sampling protocol.
- Purge water will be managed and disposed of properly.
- Peristaltic pumps will not be used to collect VOC samples.

#### **5.2.2.2 Sampling**

- Samples will be collected using equipment included and/or approved by the DEC in their guidance for “Groundwater Sampling for Emerging Contaminants” dated July 2018.
- Prior to filling the sample bottles, the temperature, pH, conductivity, dissolved oxygen, and oxidation reduction potential (ORP), and turbidity will be measured within a flow-through cell. All measurements will be recorded in the field book.
- The sample container and preservative requirements are provided in the QAPP in Appendix H of the SMP.
- The sample containers will be labelled, placed in a laboratory-supplied cooler, and packed on ice (to maintain a temperature of 4°C). The cooler will be shipped overnight or delivered to the laboratory for analysis.
- COC procedures will be followed as outlined in the QAPP (Appendix H of the SMP).
- Well sampling data will be recorded on the Groundwater Sampling Record shown in Figure 5 or similar form.

## 6.0 Indoor Air Sampling

An indoor air evaluation will be performed at the Site to establish post remedy conditions. The work will be performed in accordance with *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* [DOH, 2006] and the USEPA document entitled *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils, Office of Solid Waste and Emergency Response* [USEPA, 2002].

A pre-sampling survey and a product inventory will be conducted on the day of sampling (Figure 6). The surveys and inventories will be completed in accordance with the NYDOH guidance. The chemical inventory check will be performed at each location to document current conditions with the regard to the storage of chemicals. The previous surveys will be reviewed and any changes in conditions from the previous sampling will be noted. As with previous surveys, a screening for total volatiles will be conducted with a PID. An ambient air sample will be collected concurrently with the indoor air samples for each property.

The methods to be used for the collection of the indoor air samples and the ambient air sample are summarized as follows:

- The indoor air sample will be collected from a minimum of two-feet above the floor surface.
- The ambient air sample will be collected at a location determined to be upwind at time of sampling.
- The indoor air and ambient air samples will be collected as an integrated sample. A laboratory-provided flow controller fixed to a negative pressure vessel (a batch certified clean 6-liter Summa canister) will be used to collect the integrated sample. The controller will be a fixed-rate flow controller and the approximate length of the sample time will be set by the laboratory. The flow controllers are fitted with an internal filter to prevent particulates from entering the Summa canisters.
- The sample time for the canisters will be set from 8-24 hours depending on the use of the data. The collection of the samples in 6-liter canisters over an approximate time interval will ensure that the samples are collected at the rate specified by the NYSDOH (less than 0.2 liters per minute).
- The sample tubing will be attached to the sampling canister with Swagelok™ fittings.
- Prior to sampling, the initial vacuum in each canister will be checked prior to use to ensure mechanical integrity of the canister. The initial vacuum should be approximately 30 inches mercury (in. Hg).
- To start sampling, the canister ball valve is opened and the initial time and vacuum is recorded.
- The final vacuum should be between 10 and 4 in. Hg, with a target of 5 in. of Hg. The initial and final vacuum in each canister will be recorded on the laboratory chain-of-custody form to be returned to the laboratory with the samples. The gauges provided with the canisters are accurate only for “indication of change”, and are not sufficiently accurate to provide gauge-to-gauge comparisons. The final vacuum will also be measured in the laboratory.
- Following collection of the sample, the canister will be sealed by closing the ball valve and fitting on the canister inlet. The inlet will then be capped with a laboratory-provided threaded end cap.

- Following collection of the sample, the PID will be used to obtain a final reading from the probe assembly or tubing for the concentration of total organic vapors.
- Quality assurance and quality control samples will include one field duplicate, one trip blank, a laboratory blank and laboratory quality control samples as required by the analytical method.
- The site name, sample identification, canister number, canister certification number, sampler's name, sample times and date will be recorded on a tag that is attached to each canister.
- The indoor air samples will be shipped overnight to a NY ELAP-certified laboratory for analysis.

The field sampling team will record all information regarding the sampling chain of custody. Information to be recorded will include the following: sample identification, date and times of sample collection, identity of the field personnel, sampling methods and equipment, purge volumes and rates, and any other relevant observations made during the sampling. A DOH indoor air quality questionnaire and building inventory form will also be filled out prior to indoor air sampling.



## **7.0 Air Monitoring**

### **7.1 Introduction**

Two types of air monitoring will be performed during the site investigation: 1) work zone monitoring for protection of the workers performing the site investigation, and 2) community air monitoring at the perimeter of the work site for protection of the local community.

#### **7.1.1 Breathing Zone Air Monitoring During Drilling and Sampling**

Monitoring of air in the breathing zone within the work site will be conducted periodically during all drilling and sampling activities. A PID will be used to monitor for VOCs or other organic vapors in the breathing zone and borehole, and to screen the samples.

The PID readings will be recorded in the field book and on the boring log during drilling activities. The procedure for the PID operation and calibration is included in the HASP. Note that equipment calibration will be performed as often as needed to account for changing conditions or instrument readings. The minimum frequency of calibration is specified in the HASP; more frequent calibration will be performed if spurious readings are observed or there are other problems with the instruments.

### **7.1 Community Air Monitoring**

The procedures and action levels for community air monitoring are presented in Appendix F of the SMP.

## **8.0 Field Instruments and Calibration**

All field analytical equipment will be calibrated immediately prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. All instrument calibrations will be documented in the project field book and in an instrument calibration log. Records of all instrument calibration will be maintained by the Site Safety Coordinator (SSC). Copies of all of the instrument manuals will be maintained on site by the SSC. All changes to instrumentation will be noted in the field log book.

The following field instruments will be used during the investigation:

- PID
- Particulate monitors
- Multi-parameter meter (pH, specific conductivity, dissolved oxygen, oxidation reduction, turbidity, and temperature meter)

### **8.1 Portable Photo-Ionization Detector (PID)**

- The photo-ionization detector will be equipped with either a 10.2 or 10.6 eV lamp. In this configuration, the PID is capable of ionizing and detecting compounds that account for over 70% of the VOCs on the USEPA Target Compound List.
- Calibration must be performed at the beginning of each day of use with a standard calibration gas having a concentration of 100 parts per million of isobutylene. If the unit experiences abnormal perturbation or erratic readings, more frequent or additional calibration will be required.
- All calibration data must be recorded in the project field notebooks.
- A battery check must be completed at the beginning and end of each working day.
- All changes to the PID will be noted in the field notes (such as lamp or filter cleaning or replacement or change of instrument).

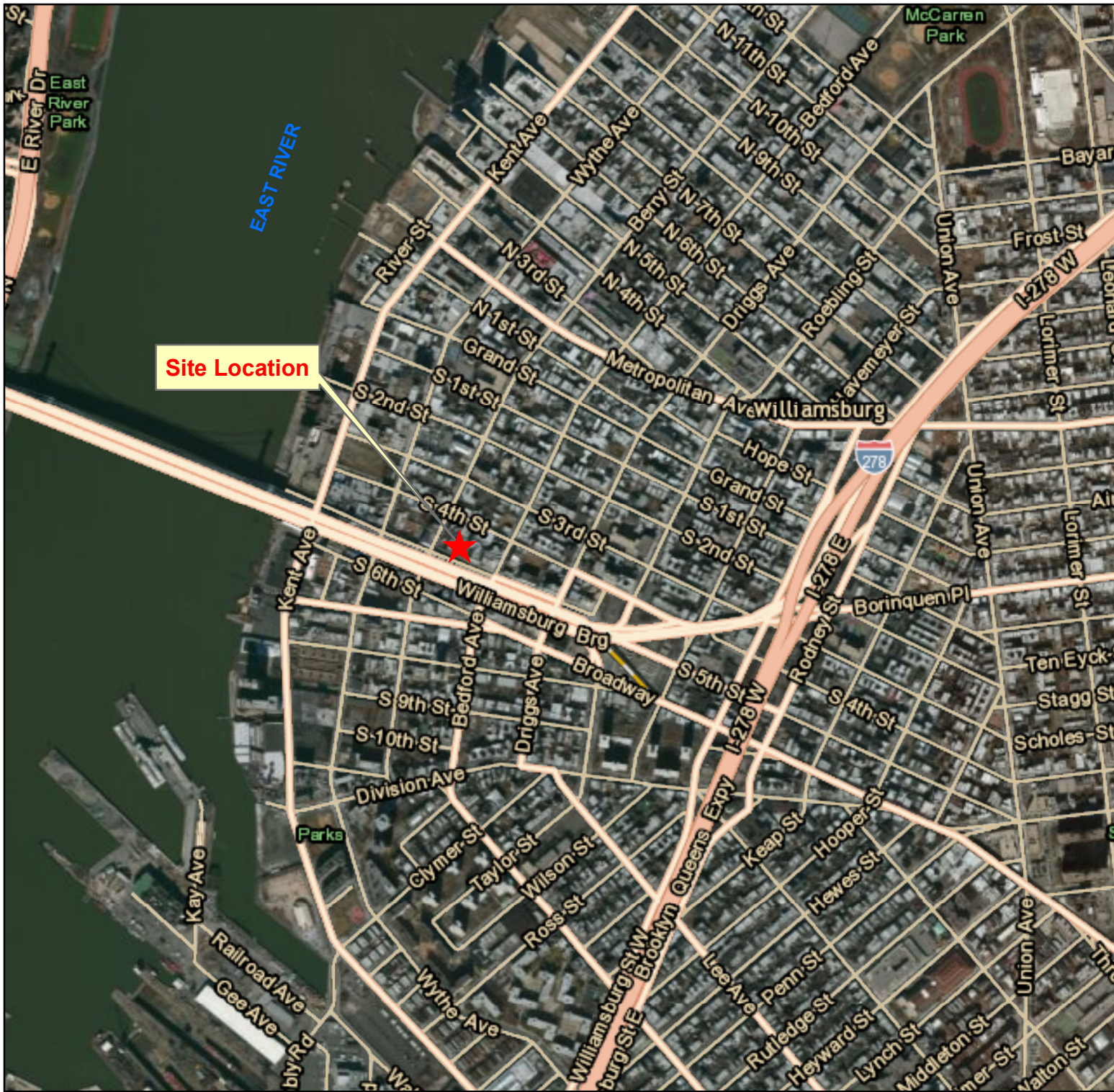
### **8.2 Multi-Parameter Meter**

- Calibration of the meter (YSI or equivalent) must be performed at the start of each day of use, and after very high or low readings as required by this Plan, according to manufacturer's instructions.
- National Institute of Standards and Technology - traceable standard calibration solutions will be used (where applicable). At least one backup meter will also be present on-site in the event of a malfunction.
- The calibration data must be recorded in the project field book each time it is performed.

## **9.0 Analytical Program**

The analytical procedures for the site are provided the QAPP in Appendix H of the SMP.

## Figure



Notes: Aerial basemap provided by Esri, HERE, DeLorme, TomTom, MapmyIndia, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo; Copyright:© OpenStreetMap contributors, and the GIS user community

0 350 700 1,400 2,100 2,800 Feet  
1 inch = 1,250 feet



## FIGURE 1 SITE LOCATION MAP

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lots 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**

227 Route 206, Suite 6, Flanders, NJ 07836, (973) 527-7451

DRAWN BY/ DATE

CHK/DATE

DRAWING NUMBER

NG / 04-14-15

2014074-01





0 40 80 160 240 320 Feet  
1 inch = 208 feet

## FIGURE 2 SITE MAP

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**

500 International Drive, Suite 150, Mount Olive, NJ 07828  
Office: (973) 527-7451 / Fax: (973) 858-0280

Notes:  
Imagery basemap provided by ESRI;  
Copyright © 2011 / USA TOPOMAPS  
National Geographic Society

DRAWN BY / DATE

CHK / DATE

DRAWING NUMBER

NG / 10-28-15

2015059-02

|                                                                            |             |           |        |           |                                                                             |                                  |                             |          |
|----------------------------------------------------------------------------|-------------|-----------|--------|-----------|-----------------------------------------------------------------------------|----------------------------------|-----------------------------|----------|
| Contractor: _____<br>Driller: _____<br>Inspector: _____<br>Rig Type: _____ |             |           |        |           | EQUITY ENVIRONMENTAL ENGINEERING, LLC                                       |                                  | Sheet _____ of _____        |          |
|                                                                            |             |           |        |           | DRILLING RECORD                                                             |                                  | boring # _____              |          |
|                                                                            |             |           |        |           | PROJECT NAME: _____                                                         |                                  | Location Description: _____ |          |
|                                                                            |             |           |        |           | PROJ. NUMBER: _____                                                         |                                  | _____                       |          |
| GROUNDWATER OBSERVATIONS                                                   |             |           |        |           | Weather: _____<br><br>Date/Time Start: _____<br><br>Date/Time Finish: _____ |                                  | Location Plan               |          |
| Water Level                                                                |             |           |        |           |                                                                             |                                  |                             |          |
| Date                                                                       |             |           |        |           |                                                                             |                                  |                             |          |
| Time                                                                       |             |           |        |           |                                                                             |                                  |                             |          |
| Meas. From                                                                 |             |           |        |           |                                                                             |                                  |                             |          |
| Sample Depth                                                               | Sample I.D. | Inch Rec. | XRF Pb | PID (ppm) | USCS                                                                        | FIELD IDENTIFICATION OF MATERIAL | SCHEMATIC                   | COMMENTS |
| 0                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 1                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 2                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 3                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 4                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 5                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 6                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 7                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 8                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 9                                                                          |             |           |        |           |                                                                             |                                  |                             |          |
| 10                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 11                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 12                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 13                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 14                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 15                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 16                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 17                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 18                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 19                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
| 20                                                                         |             |           |        |           |                                                                             |                                  |                             |          |
|                                                                            |             |           |        |           |                                                                             |                                  |                             |          |
|                                                                            |             |           |        |           |                                                                             |                                  |                             |          |
|                                                                            |             |           |        |           |                                                                             |                                  |                             |          |
| COMMENTS:                                                                  |             |           |        |           |                                                                             |                                  |                             |          |
| SAMPLING METHOD                                                            |             |           |        |           |                                                                             | _____                            |                             |          |
| SS = SPLIT SPOON                                                           |             |           |        |           |                                                                             | _____                            |                             |          |
| A = AUGER CUTTINGS                                                         |             |           |        |           |                                                                             | _____                            |                             |          |
| GP = GEOPROBE - DIRECT PUSH                                                |             |           |        |           |                                                                             | _____                            |                             |          |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                |                |           |            |             |     |                                  |                   |                          |               |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|----------------|-----------|------------|-------------|-----|----------------------------------|-------------------|--------------------------|---------------|
| <b>Equity Environmental Engineering</b><br>500 International Drive, Suite 150<br>Mount Olive, New Jersey 07828                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                |                |           |            |             |     | CLIENT:<br>PROJECT:<br>LOCATION: |                   | SB/WELL ID:<br>PERMIT #: |               |
| START DATE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |                |                |           |            |             |     | DRILLING CO.:                    |                   | TOTAL DEPTH:             |               |
| COMPLETION DATE:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                |                |           |            |             |     | DRILLER:                         |                   | WELL DEPTH:              |               |
| BORING DIAMETER:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |           |                |                |           |            |             |     | DRILL RIG / METHOD:              |                   | CASING ELEVATION:        |               |
| WELL DIAMETER:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |           |                |                |           |            |             |     | LOGGED BY:                       |                   | DEPTH TO WATER:          |               |
| SCREENED INTERVAL:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     | WELL TYPE:                       |                   | WATER LEVEL STATIC:      |               |
| SCREEN TYPE / SLOT:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |                |                |           |            |             |     | FILTER PACK:                     |                   | CASING TYPE:             |               |
| Depth (Ft.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Sample ID | Recovery (in.) | Interval (Ft.) | PID (ppm) | Reading At | Sample Type | H2O | Lithology / Remarks              | Well Construction |                          |               |
| 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 0                 |                          | 4" Dia<br>PVC |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 1                 |                          |               |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 2                 |                          |               |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 3                 |                          |               |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 4                 |                          |               |
| 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 5                 |                          |               |
| 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 6                 |                          |               |
| 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 7                 |                          |               |
| 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 8                 |                          |               |
| 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |                |                |           |            |             |     |                                  | 9                 |                          |               |
| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 10                |                          |               |
| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 11                |                          |               |
| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 12                |                          |               |
| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 13                |                          |               |
| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 14                |                          |               |
| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 15                |                          |               |
| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 16                |                          |               |
| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 17                |                          |               |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 18                |                          |               |
| 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 19                |                          |               |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |           |                |                |           |            |             |     |                                  | 20                |                          |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |           |                |                |           |            |             |     |                                  |                   |                          |               |
| <b>KEY:</b><br>SPT = Standard Penetration Test      SS = Split Spoon      BH = Bore Hole      HS = Headspace      TOSC = Top of Screen<br>CAL = Calibration      A = Auger Cuttings      GS = Grab Sample      W = Water Level      TOS = Top of Sand<br>BZ = Breathing Zone      GP = Geoprobe      C = Composite      TOB = Top of Bentonite      CB = Curb Box<br><div><div><div></div>Grout</div><div><div></div>Bentonite</div><div><div></div>Sand</div><div><div></div>Screen</div></div> <div><div><div></div>SP-SM</div><div><div></div>SM</div><div><div></div>SP</div><div><div></div>ROCK</div><div><div></div>SW</div></div> |           |                |                |           |            |             |     |                                  |                   |                          |               |

Page 1 of 1



## GROUNDWATER SAMPLING LOG

**SITE:**  
**ADDRESS:**

**Monitoring Well:**

Depth to Water (feet): \_\_\_\_\_ Date: \_\_\_\_\_  
 Total Well Depth (feet): \_\_\_\_\_ Samplers: \_\_\_\_\_  
 Casing Diameter (inches): \_\_\_\_\_  
 Water Column (feet): \_\_\_\_\_ Weather Conditions: \_\_\_\_\_  
 Water Column Volume (gallons): \_\_\_\_\_  
 Screened/Open Interval: \_\_\_\_\_

**Purging Information**

Start Time: \_\_\_\_\_ Purge Method: (Circle One)  
 End Time: \_\_\_\_\_  
 Purge Rate (gpm or/ lpm): \_\_\_\_\_ Centrifugal pump  
 Total Volume Removed: \_\_\_\_\_ (Gallons or/ Liters) Submersible Pump **Dedicated Low Flow**  
 Peristaltic Pump Bailer  
 Other: \_\_\_\_\_

| Time                        |  |  |  |  |  |  |  |  |  |  |
|-----------------------------|--|--|--|--|--|--|--|--|--|--|
| Volume (Liters/Gallons)     |  |  |  |  |  |  |  |  |  |  |
| Depth to Water              |  |  |  |  |  |  |  |  |  |  |
| Temperature (deg. C)*       |  |  |  |  |  |  |  |  |  |  |
| pH                          |  |  |  |  |  |  |  |  |  |  |
| ORP/Redox                   |  |  |  |  |  |  |  |  |  |  |
| Conductivity (mS/cm)* [S/m] |  |  |  |  |  |  |  |  |  |  |
| Turbidity (NTU)             |  |  |  |  |  |  |  |  |  |  |
| DO (mg/L)*                  |  |  |  |  |  |  |  |  |  |  |
| TDS                         |  |  |  |  |  |  |  |  |  |  |
| Salinity (ppt)              |  |  |  |  |  |  |  |  |  |  |

\* Make sure meter are set to read in these settings - ex. DO is set to mg/L not %.

**Sampling Information**

Sample ID: \_\_\_\_\_ Sampling Method/Equipment: \_\_\_\_\_ Pump Intake Depth: \_\_\_\_\_  
 Sample Time: \_\_\_\_\_ Depth to Water: \_\_\_\_\_

| Analyte Group | Bottle Type | Number | Preservation | Analyzed? |
|---------------|-------------|--------|--------------|-----------|
|               |             |        |              |           |
|               |             |        |              |           |
|               |             |        |              |           |
|               |             |        |              |           |
|               |             |        |              |           |
|               |             |        |              |           |
|               |             |        |              |           |
|               |             |        |              |           |

Metals Filtered? Yes / No

Sample Rate (gpm/lpm): \_\_\_\_\_

Comments/Observations for sampling event pertaining to this well:

**Misc Field Info/Reference:**

Well Volume:

|                      |      |      |      |      |      |     |     |     |
|----------------------|------|------|------|------|------|-----|-----|-----|
| Case Dia (inches):   | 2    | 3    | 4    | 4.5  | 5    | 6   | 8   | 12  |
| Gallons/linear Foot: | 0.17 | 0.38 | 0.66 | 0.83 | 1.02 | 1.5 | 2.6 | 5.8 |

For Low Flow

**Stabilization Order/Range**

Three successive reading within:

\*pH: +/- 0.1  
 \*SC (Conductivity): +/- 3% SC - Specific Conductance  
 ORP: +/- 10mV  
 \*DO: +/- 10%  
 Turb: +/- 10% for levels greater than 1 NTU  
 Temp: +/- 3%  
 Water Level Drawdown: <0.3 ft

**NEW YORK STATE DEPARTMENT OF HEALTH  
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY  
CENTER FOR ENVIRONMENTAL HEALTH**

This form must be completed for each residence involved in indoor air testing.

Preparer's Name \_\_\_\_\_ Date/Time Prepared \_\_\_\_\_

Preparer's Affiliation \_\_\_\_\_ Phone No. \_\_\_\_\_

Purpose of Investigation \_\_\_\_\_

**1. OCCUPANT:**

**Interviewed: Y / N**

Last Name: \_\_\_\_\_ First Name: \_\_\_\_\_

Address: \_\_\_\_\_

County: \_\_\_\_\_

Home Phone: \_\_\_\_\_ Office Phone: \_\_\_\_\_

Number of Occupants/persons at this location \_\_\_\_\_ Age of Occupants \_\_\_\_\_

**2. OWNER OR LANDLORD: (Check if same as occupant \_\_\_\_)**

**Interviewed: Y / N**

Last Name: \_\_\_\_\_ First Name: \_\_\_\_\_

Address: \_\_\_\_\_

County: \_\_\_\_\_

Home Phone: \_\_\_\_\_ Office Phone: \_\_\_\_\_

**3. BUILDING CHARACTERISTICS**

**Type of Building:** (Circle appropriate response)

Residential  
Industrial

School  
Church

Commercial/Multi-use  
Other: \_\_\_\_\_

**If the property is residential, type?** (Circle appropriate response)

|              |                 |                   |
|--------------|-----------------|-------------------|
| Ranch        | 2-Family        | 3-Family          |
| Raised Ranch | Split Level     | Colonial          |
| Cape Cod     | Contemporary    | Mobile Home       |
| Duplex       | Apartment House | Townhouses/Condos |
| Modular      | Log Home        | Other: _____      |

**If multiple units, how many?** \_\_\_\_\_

**If the property is commercial, type?**

Business Type(s) \_\_\_\_\_

Does it include residences (i.e., multi-use)? Y / N      If yes, how many? \_\_\_\_\_

**Other characteristics:**

Number of floors \_\_\_\_\_

Building age \_\_\_\_\_

Is the building insulated? Y / N

How air tight? Tight / Average / Not Tight

#### 4. AIRFLOW

**Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:**

Airflow between floors

---



---



---

Airflow near source

---



---



---

Outdoor air infiltration

---



---



---

Infiltration into air ducts

---



---



---

**5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)**

- a. Above grade construction: wood frame concrete stone brick
- b. Basement type: full crawlspace slab other \_\_\_\_\_
- c. Basement floor: concrete dirt stone other \_\_\_\_\_
- d. Basement floor: uncovered covered covered with \_\_\_\_\_
- e. Concrete floor: unsealed sealed sealed with \_\_\_\_\_
- f. Foundation walls: poured block stone other \_\_\_\_\_
- g. Foundation walls: unsealed sealed sealed with \_\_\_\_\_
- h. The basement is: wet damp dry moldy
- i. The basement is: finished unfinished partially finished
- j. Sump present? Y / N
- k. Water in sump? Y / N / not applicable

Basement/Lowest level depth below grade: \_\_\_\_\_ (feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

---



---

**6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)**

Type of heating system(s) used in this building: (circle all that apply – note primary)

|                     |                  |                     |             |
|---------------------|------------------|---------------------|-------------|
| Hot air circulation | Heat pump        | Hot water baseboard |             |
| Space Heaters       | Stream radiation | Radiant floor       |             |
| Electric baseboard  | Wood stove       | Outdoor wood boiler | Other _____ |

The primary type of fuel used is:

|             |          |          |
|-------------|----------|----------|
| Natural Gas | Fuel Oil | Kerosene |
| Electric    | Propane  | Solar    |
| Wood        | Coal     |          |

Domestic hot water tank fueled by: \_\_\_\_\_

Boiler/furnace located in: Basement Outdoors Main Floor Other \_\_\_\_\_

Air conditioning: Central Air Window units Open Windows None

Are there air distribution ducts present? Y / N

**Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.**

---



---



---



---

## 7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

**Level                      General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**

|                       |       |
|-----------------------|-------|
| Basement              | <hr/> |
| 1 <sup>st</sup> Floor | <hr/> |
| 2 <sup>nd</sup> Floor | <hr/> |
| 3 <sup>rd</sup> Floor | <hr/> |
| 4 <sup>th</sup> Floor | <hr/> |

## 8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

- |                                                                                                |                                    |
|------------------------------------------------------------------------------------------------|------------------------------------|
| a. Is there an attached garage?                                                                | Y / N                              |
| b. Does the garage have a separate heating unit?                                               | Y / N / NA                         |
| c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) | Y / N / NA<br>Please specify <hr/> |
| d. Has the building ever had a fire?                                                           | Y / N    When? <hr/>               |
| e. Is a kerosene or unvented gas space heater present?                                         | Y / N    Where? <hr/>              |
| f. Is there a workshop or hobby/craft area?                                                    | Y / N    Where & Type? <hr/>       |
| g. Is there smoking in the building?                                                           | Y / N    How frequently? <hr/>     |
| h. Have cleaning products been used recently?                                                  | Y / N    When & Type? <hr/>        |
| i. Have cosmetic products been used recently?                                                  | Y / N    When & Type? <hr/>        |

- j. Has painting/staining been done in the last 6 months? Y / N Where & When? \_\_\_\_\_
- k. Is there new carpet, drapes or other textiles? Y / N Where & When? \_\_\_\_\_
- l. Have air fresheners been used recently? Y / N When & Type? \_\_\_\_\_
- m. Is there a kitchen exhaust fan? Y / N If yes, where vented? \_\_\_\_\_
- n. Is there a bathroom exhaust fan? Y / N If yes, where vented? \_\_\_\_\_
- o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N
- p. Has there been a pesticide application? Y / N When & Type? \_\_\_\_\_

Are there odors in the building? Y / N  
If yes, please describe: \_\_\_\_\_

Do any of the building occupants use solvents at work? Y / N  
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist)

If yes, what types of solvents are used? \_\_\_\_\_

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

|                                                      |         |
|------------------------------------------------------|---------|
| Yes, use dry-cleaning regularly (weekly)             | No      |
| Yes, use dry-cleaning infrequently (monthly or less) | Unknown |
| Yes, work at a dry-cleaning service                  |         |

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: \_\_\_\_\_  
Is the system active or passive? Active/Passive

## 9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: \_\_\_\_\_

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well Other: \_\_\_\_\_

## 10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: \_\_\_\_\_

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

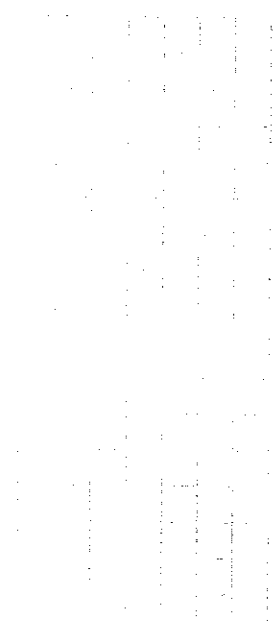
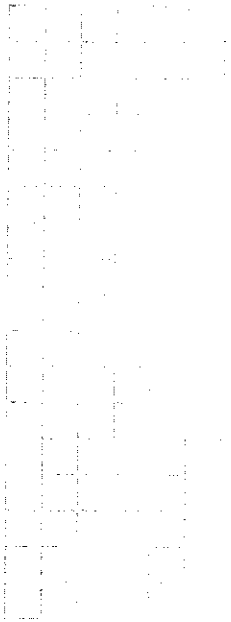
c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

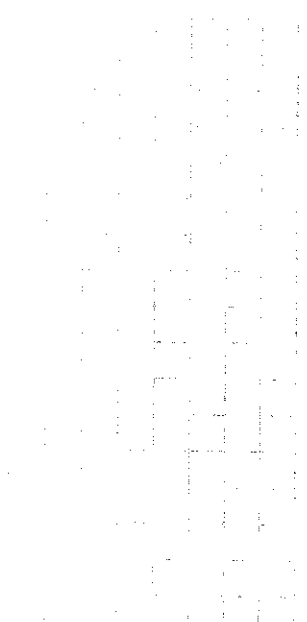
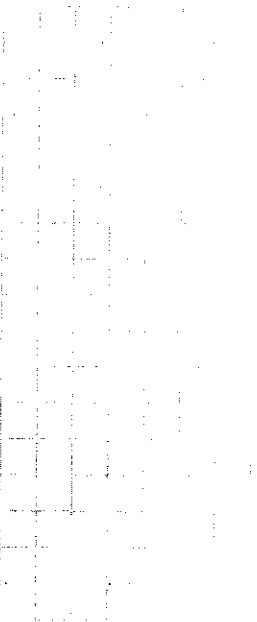
**11. FLOOR PLANS**

**Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.**

**Basement:**



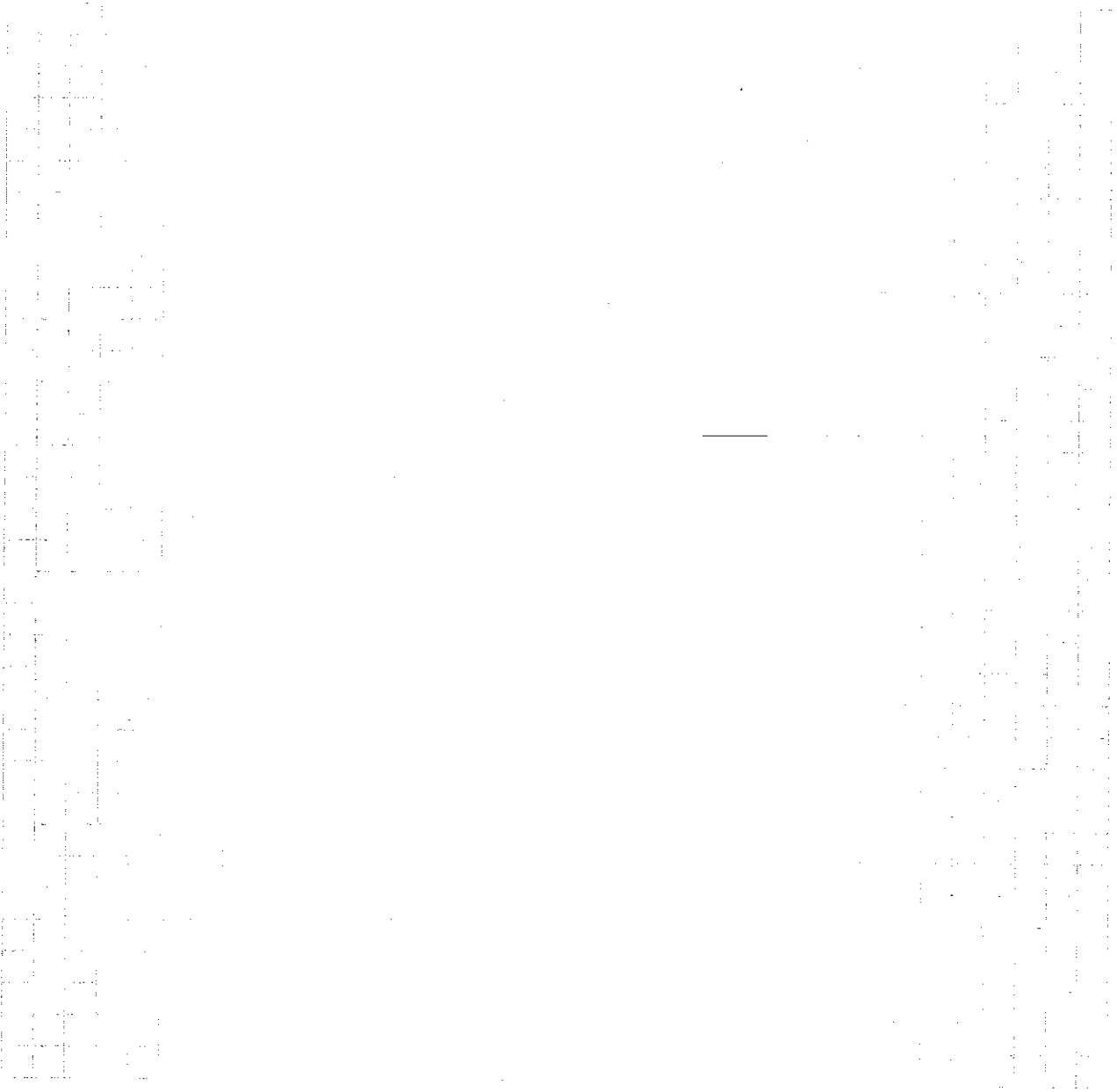
**First Floor:**



**12. OUTDOOR PLOT**

**Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.**

**Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.**





**Make & Model of field instrument used:** \_\_\_\_\_

**\*\* Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.**

## **APPENDIX K**

### **REMEDIAL SYSTEM OPTIMIZATION TABLE OF CONTENTS**

# REMEDIAL SYSTEM OPTIMIZATION FOR THE WILLIAMSBURG BRIDGEVIEW APARTMENTS

## TABLE OF CONTENTS

### 1.0 INTRODUCTION

#### 1.1 SITE OVERVIEW

#### 1.2 PROJECT OBJECTIVES AND SCOPE OF WORK

#### 1.3 REPORT OVERVIEW

### 2.0 REMEDIAL ACTION DESCRIPTION

#### 2.1 SITE LOCATION AND HISTORY

#### 2.2 REGULATORY HISTORY AND REQUIREMENTS

#### 2.3 CLEAN-UP GOALS AND SITE CLOSURE CRITERIA

#### 2.4 PREVIOUS REMEDIAL ACTIONS

#### 2.5 DESCRIPTION OF EXISTING REMEDY

##### 2.5.1 System Goals and Objectives

##### 2.5.2 System Description

##### 2.5.3 Operation and Maintenance Program

### 3.0 FINDINGS AND OBSERVATIONS

#### 3.1 SUBSURFACE PERFORMANCE

#### 3.2 TREATMENT SYSTEM PERFORMANCE

#### 3.3 REGULATORY COMPLIANCE 3-3

#### 3.4 MAJOR COST COMPONENTS OR PROCESSES

#### 3.5 SAFETY RECORD

### 4.0 RECOMMENDATIONS

#### 4.1 RECOMMENDATIONS TO ACHIEVE OR ACCELERATE SITE CLOSURE

##### 4.1.1 Source Reduction/Treatment

##### 4.1.2 Sampling

##### 4.1.3 Conceptual Site Model (Risk Assessment)

#### 4.2 RECOMMENDATIONS TO IMPROVE PERFORMANCE

##### 4.2.1 Maintenance Improvements

##### 4.2.2 Monitoring Improvements

4.2.3 Process Modifications

4.3 RECOMMENDATIONS TO REDUCE COSTS

4.3.1 Supply Management

4.3.2 Process Improvements or Changes

4.3.3 Optimize Monitoring Program

4.3.4 Maintenance and Repairs

4.4 RECOMMENDATIONS FOR IMPLEMENTATION

**APPENDIX L**  
**PERMITS AND/OR PERMIT EQUIVALENT**



Buildings



# Work Permit Department of Buildings

Permit Number: 320597378-01-FO-EA

Issued: 05/15/2018

Expires: 05/15/2019

Address: BROOKLYN 101 SOUTH 5TH STREET

Issued to: JOSEPH PROCIDA

Business: PROCIDA CONSTRUCTION CORP

Contractor No: GC-1863

## Description of Work:

NEW BUILDING - EARTHWORK CONSTRUCT NEW 11 STORY MIXED USE BUILDING.

Review is requested under Building Code: 2008

SITE FILL: USE UNDER 300 C

To see a Zoning Diagram (ZD1) or to challenge a zoning approval filed as part of a New Building application or Alteration application filed after 7/13/2009, please use "My Community" on the Buildings Department web site at [www.nyc.gov/buildings](http://www.nyc.gov/buildings).

Emergency Telephone Day or Night: 311 SITE SAFETY PHONE : 212 669-7043

Borough Commissioner:

Commissioner of Buildings:

Tampering with or knowingly making a false entry in or falsely altering this permit is a crime that is punishable by a fine, imprisonment or both.

03 07/26/2018

## **APPENDIX M**

### **RESPONSIBILITIES OF OWNER**

#### **Responsibilities**

The responsibilities for implementing the Site Management Plan (“SMP”) for the Williamsburg Bridgeview Apartments site (the “site”), number C224233, are to be implemented by the site beneficial owner who is also the Remedial Party, as defined below. The beneficial owner(s) is/are currently listed LPC Development Group LLC (owner).

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party (“RP”) refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation (“NYSDEC”) is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is also the owner.

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

#### **Site Beneficial Owner’s Responsibilities:**

- 1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.
- 2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in an Environmental Easement remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP’s request, in order to allow the RP to include the certification in the site’s Periodic Review Report (PRR) certification to the NYSDEC.

- 3) In the event the site is delisted, the owner remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.
- 4) The owner shall grant access to the site to the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.
- 5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the NYSDEC in accordance with the timeframes indicated in Section 1.3-Notifications.
- 6) In the event some action or inaction by the owner adversely impacts the site, the owner must notify the NYSDEC in accordance with the time frame indicated in 1.3-Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.
- 7) The owner must notify the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site property. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at <http://www.dec.ny.gov/chemical/76250.html>.
- 8) Until such time as the NYSDEC deems the vapor mitigation system unnecessary, the owner shall operate the system, pay for the utilities for the system's operation, and report any maintenance issues to the NYSDEC.
- 9) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.



### **Remedial Party Responsibilities**

For this site, the beneficial owner is the RP.

- 1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.
- 2) The RP shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.
- 3) Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the site visit and/or any final report produced.
- 4) If the NYSDEC determines that an update of the SMP is necessary, the RP shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the RP shall submit a copy of the approved SMP to the owner(s).
- 5) The RP shall notify the NYSDEC and the owner of any changes in RP ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). The RP shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at <http://www.dec.ny.gov/chemical/76250.html>.
- 6) The RP shall notify the NYSDEC of any damage to or modification of the systems as required under Section 1.3- Notifications of the SMP.
- 7) The RP is responsible for the proper maintenance of any installed vapor intrusion mitigation systems associated with the site, as required in Appendix G (Operation, Monitoring and Maintenance Manual) of the SMP.
- 8) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the RP shall submit to the NYSDEC for approval an amended SMP.
- 9) Any change in use, change in ownership, change in site classification (e.g., delisting), reduction or expansion of remediation, and other significant changes related to the site

may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. The RP shall contact the Department to discuss the need to update such documents.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

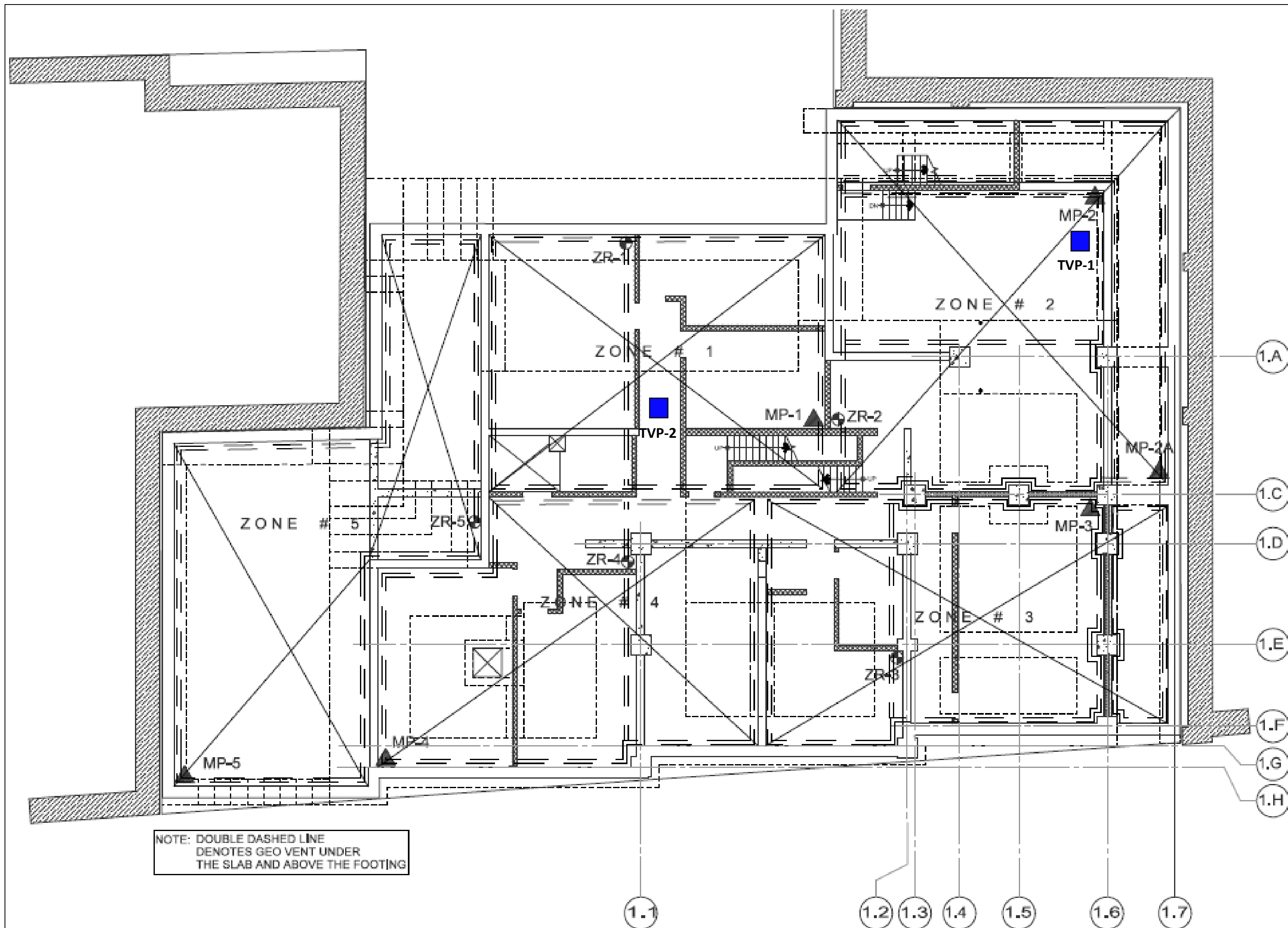
## **Appendix B**

### **Cover System**

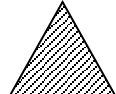


## **Appendix C**

### **Sub-Slab Depressurization System Layout**



### Legend

-  MP-1 - Monitoring Point
-  ZR-1 - Extraction Point
-  Geovent
-  TVP- Temporary Point

**FIGURE 5**  
**Sub-Slab Depressurization**  
**Systems**

337 Berry St. & 99-105 South 5th St.  
(Block 2443 / Lot 6, 37, 41)  
Brooklyn, New York



**equity environmental engineering**

500 International Drive, Suite 150, Mount Olive, NJ 07828  
Office: (973) 527-7451 / Fax: (973) 858-0280

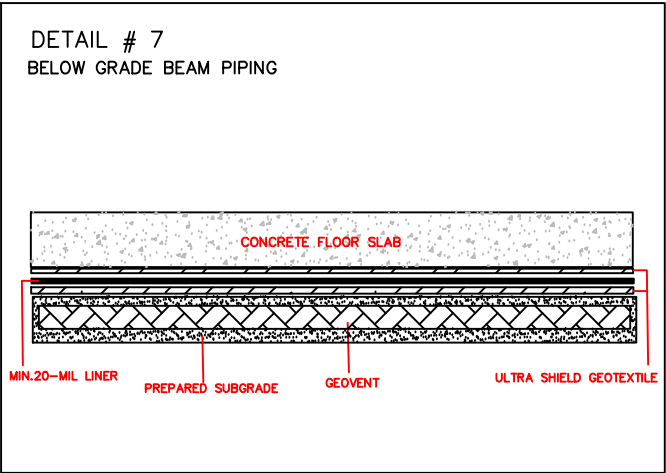
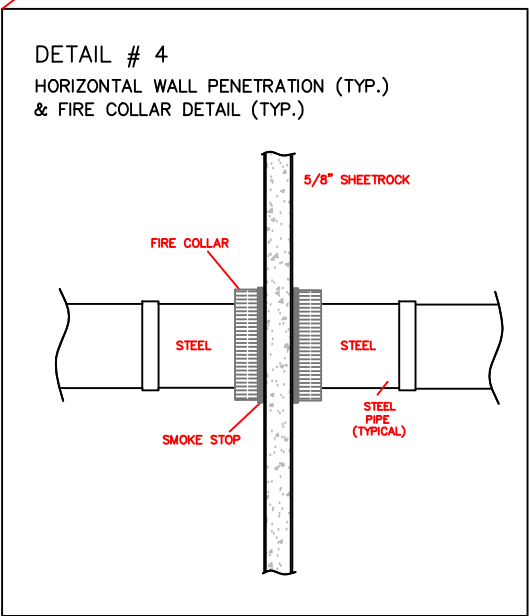
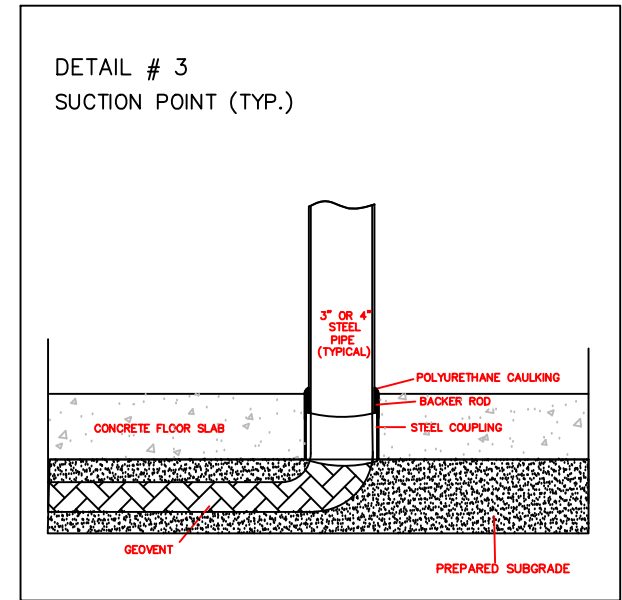
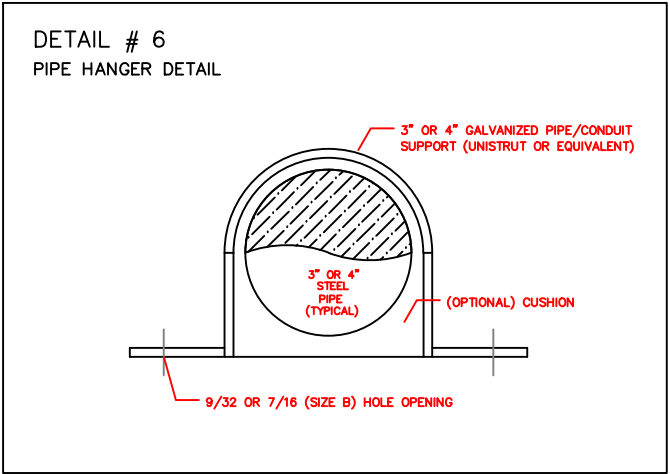
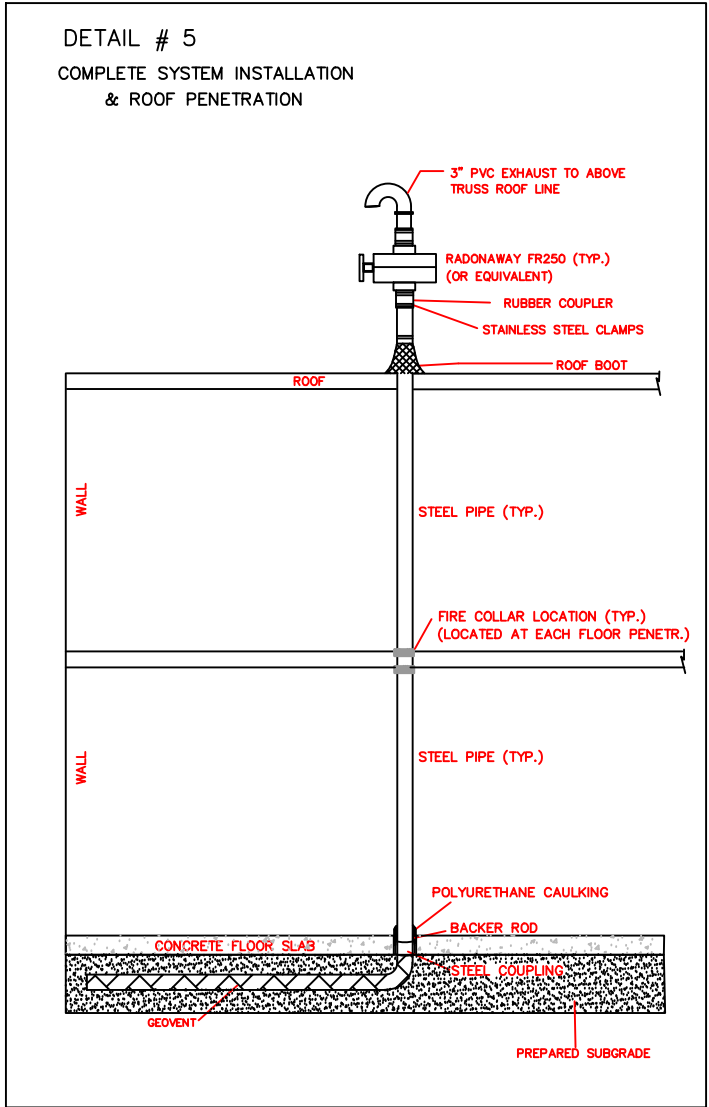
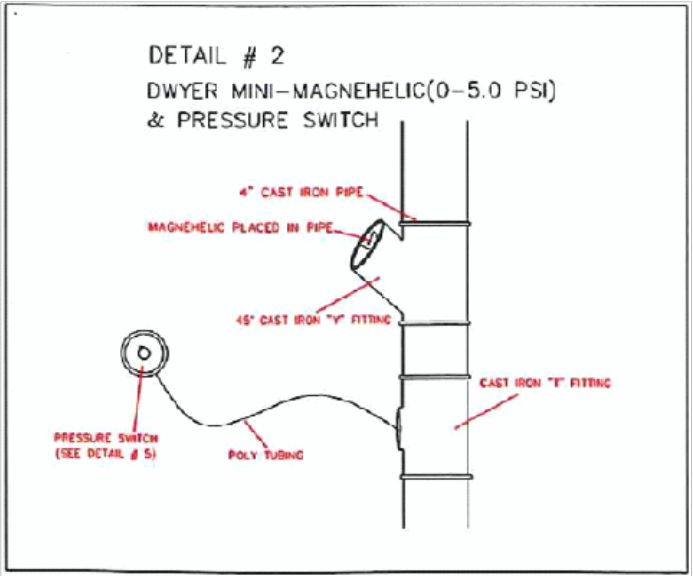
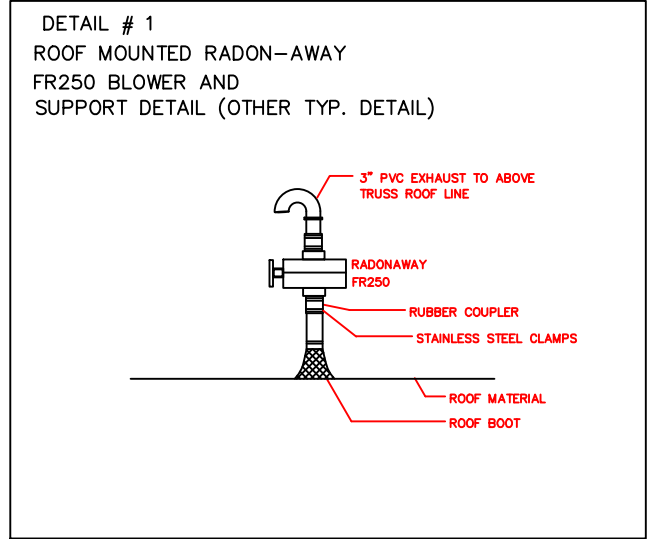
DRAWN BY / DATE

CHK / DATE

DRAWING NUMBER

JV / 01-03-17

2015059-05

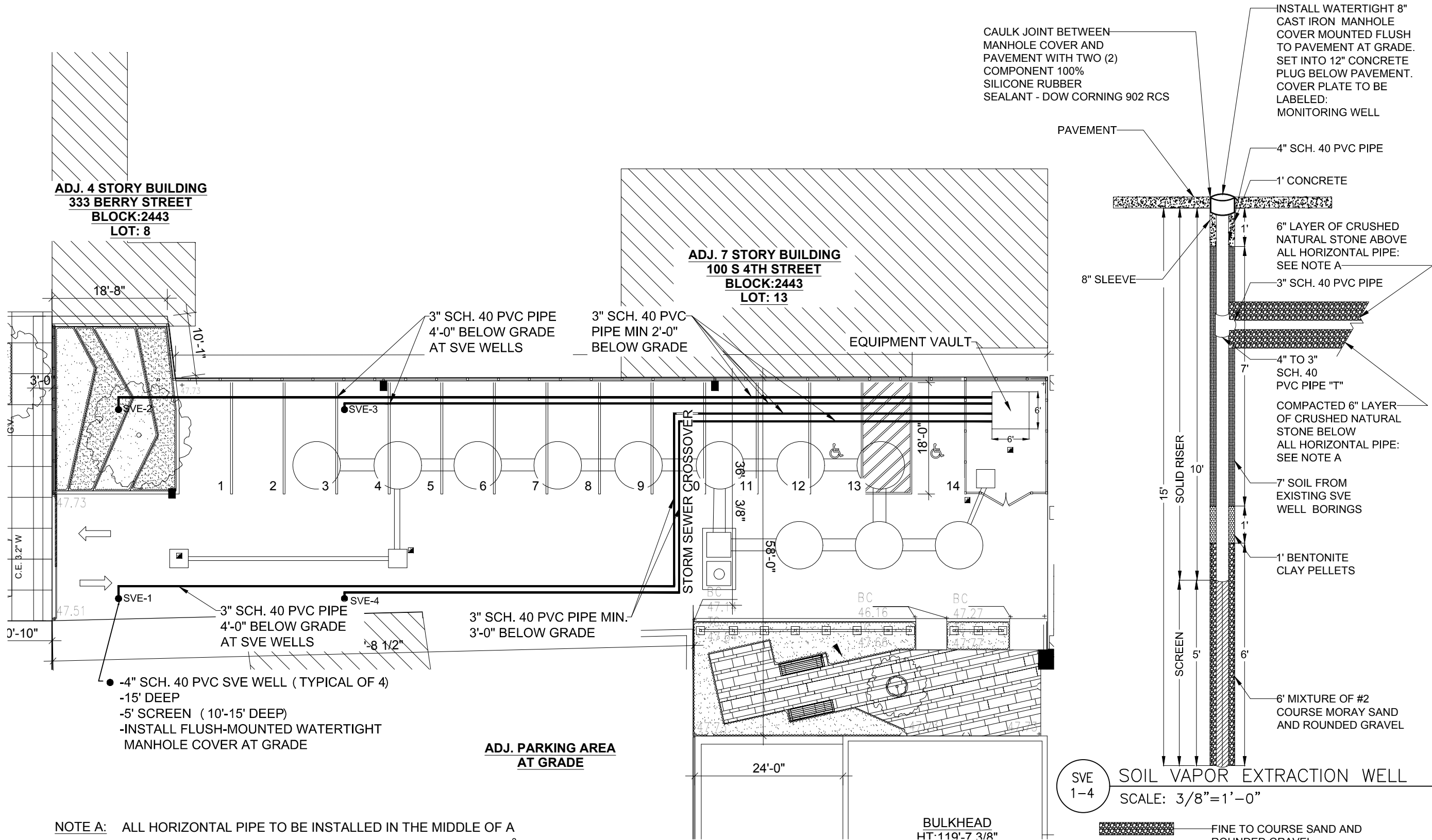


| FIGURE 6                                                                                                                                                                                                             |        |     |     |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|-----|
| VAPOR MITIGATION SYSTEM<br>337 BERRY STREET<br>BROOKLYN, NEW YORK<br>DETAIL SHEET                                                                                                                                    |        |     |     |
|  <b>Equity Environmental Engineering LLC</b><br>500 International Drive, Suite 150<br>Mt. Olive, NJ 07828 Phone: (973) 527-7451 |        |     |     |
| DATE                                                                                                                                                                                                                 | DWG BY | REV | CHK |
| 11082016                                                                                                                                                                                                             | TAF    | FU  |     |

## **Appendix D**

### **Soil Vapor Extraction System Layout**

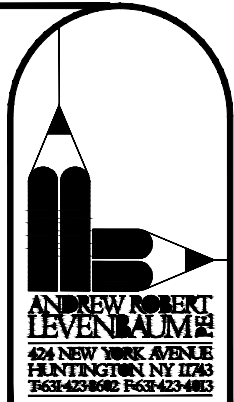




**NOTE A:** ALL HORIZONTAL PIPE TO BE INSTALLED IN THE MIDDLE OF A 12" LAYER OF CRUSHED NATURAL BLUESTONE, MINIMUM OF  $\frac{3}{4}$ " SIZE, FREE OF ALL FRIABLE MATERIAL AND DEBRIS, GRADED IN ACCORDANCE WITH ASTM C136; ALL MATERIAL TO BE ABLE TO PASS THROUGH A 2" SEIVE.

**NOTE B:** SVE WELL QUANTITY AND LOCATIONS ARE SUBJECT TO PILOT WELL TESTING.

- FINE TO COURSE SAND AND ROUNDED GRAVEL
- BENTONITE PELLETS
- BANK RUN SAND AND GRAVEL
- CONCRETE
- SVE — SOIL VAPOR EXTRACTION WELL



STRUCTURAL CONSULTANT:  
MEPS CONSULTANT:

THE DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS PREPARED BY THE ARCHITECT AND PROFESSIONAL ENGINEER FOR THIS PROJECT ARE THE INSTRUMENTS OF THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S SERVICES FOR USE SOLELY WITH RESPECT TO THIS PROJECT AND, UNLESS OTHERWISE PROVIDED, THE ARCHITECT AND PROFESSIONAL ENGINEER SHALL BE DEEMED THE AUTHOR OF THESE DOCUMENTS AND SHALL RETAIN ALL COMMON LAW, STATUTORY AND OTHER RESERVED RIGHTS INCLUDING COPYRIGHT. THE OWNER SHALL BE PERMITTED TO RETAIN COPIES OF THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS FOR THE PROJECT. THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S DRAWINGS SHALL NOT BE USED BY THE OWNER OR OTHERS ON OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR FOR COMPLETION OF THIS PROJECT BY OTHERS.

| NO | DESCRIPTION | DATE |
|----|-------------|------|
|    |             |      |
|    |             |      |
|    |             |      |
|    |             |      |

PROJECT DATA:  
**ALTERATIONS & ADDITIONS TO:**  
337 BERRY STREET  
BROOKLYN, NY, 11249

JOB NUMBER: 593

DOB BSCAN:

DRAWING TITLE:  
**SITE PLAN**

DRAWN BY: SCF  
CHECKED BY: ARL  
SCALE:  $\frac{1}{8}" = 1'-0"$   
DATE: 06.05.17  
**C-101.00**  
1 of 1

## **Appendix E**

### **SVES Implementation Plan**

# Advanced Cleanup Technologies, Inc.

ENVIRONMENTAL CONSULTANTS

August 8, 2017

Mr. Peter Procida  
LPC Developmet Group LLC  
456 East 173<sup>rd</sup> Street  
Bronx, New York 10457

Re: Soil Vapor Extraction System Implementation Plan  
337 Berry Street, Brooklyn, New York

Dear Mr. Procida,

Advanced Cleanup Technologies, Inc. (ACT) is pleased to present the following Implementation Plan for the construction of the proposed Soil Vapor Extraction (SVE) system at 337 Berry Street, Brooklyn, New York. A preliminary design plan providing the proposed number and layout of SVE wells and system piping is attached. A Typical P&ID diagram for the SVE system is also attached.

The following outlines the details of construction and the methodology and sequencing of the construction related activities. The ground surface over the area to be remediated is currently bare dirt. Hence, vacuum measurements recorded during pilot testing will be viewed as conservative, with higher vacuum anticipated once the asphalt pavement has been installed.

## Scope of Work

### **1. Pilot Testing**

The New York State Department of Health (NYSDOH) has indicated that a minimum vacuum of 0.1 in. w.c. is required to maintain an effective vacuum within an area influenced by an SVE system. A pilot test will be performed on an SVE well to be installed along the property boundary adjacent to 333 Berry Street to generate site-specific permeability data under varying conditions of pressure, flow and distance.

Prior to pilot testing, temporary vacuum points will be installed at 5, 10 and 15 foot depths along the property boundary with 333 Berry Street and at one 10-foot step out to the south. Temporary sub-slab vacuum points (less than 6 in. deep) will also be installed inside the basement at 333 Berry Street at three distances from the southern property boundary.

LPC Developmet Group LLC  
August 8, 2017  
Page Two

The results of the pilot test will document the extraction well vacuum and flow rates required to maintain effective horizontal and vertical pressure fields beneath the site and its immediate vicinity. This information will be used to refine the proposed layout of the SVE system and sizing of vacuum blower and treatment equipment. The blower will be selected with approval from the NYSDEC.

## **2. Trenching**

A backhoe will be utilized to dig a trench from each extraction well to lateral piping connecting the SVE well to the vacuum system. An additional trench will be dug along the northern property boundary to contain lateral piping from each SVE well to the vacuum system.

## **3. Extraction Well Installation**

Each SVE well will be installed utilizing a rotary auger drill rig, which will drill an 8-inch diameter borehole to a depth of 15 feet below ground surface (bgs). The entire well assembly, including 5 feet of 4-inch diameter 20 mil slotted schedule 40 PVC well screen and 10 feet of 4-inch diameter solid PVC riser pipe, will be inserted into the borehole. A 4-inch to 3-inch PVC "T" will be installed four feet from the top of the well casing to provide connection to lateral piping.

The borehole will be filled with 6 feet of well gravel (#2 moray sand and rounded gravel) followed by 1 foot of hydrated bentonite clay pellets and then native soil to 1-foot bgs. An 8-inch diameter well cover labeled "Monitoring Well" will be installed at an elevation flush with the asphalt surface. The well cover will be secured in place with a concrete plug, inhibiting surface water infiltration into the well annulus.

## **4. Lateral Piping Installation**

A 6-inch layer of crushed natural bluestone will be placed in the base of each pipe trench. A layer of filter fabric will be placed between the bluestone and the native soil. Three-inch diameter schedule 40 PVC piping will be laid out in the trenches in 10-foot sections. Each section will be welded to the next with PVC primer and cement. Care will be taken to make sure PVC couplings are fully inserted and dry before moving to the next section. Lateral piping will be covered with a 6-inch layer of crushed stone. The trenches will then be backfilled with native soil to grade.

LPC Developmet Group LLC  
August 8, 2017  
Page Three

## **5. Vacuum System Installation**

Located in the northeast portion of the asphalt driveway, a vacuum system consisting of a vacuum blower, moisture separator, pre-filter, instrumentation and controls will be installed within a pre-fabricated metal enclosure. (See Attachment A for the proposed location of the vacuum system).

The enclosure will be soundproofed to reduce the sound level of the blower. Provisions to alternatively mount the vacuum system and enclosure on the roof of the building under construction will be made if it is determined that this would be a more suitable location.

## **6. Exhaust Treatment**

Prior to operational startup, the vacuum system exhaust will be sampled and analyzed for volatile organic compounds pursuant to EPA Method TO-15. An ambient Air Quality Impact Analysis will be performed in accordance with NYS DAR-1 guidelines to determine if treatment of exhaust with granular activated carbon will be required.

## **7. Electrical Work**

The vacuum system will be energized using a new electrical distribution panel installed by the client. Circuit breakers will be labeled "Active Soil Vapor Extraction System." Additionally, a system description label will be placed on the vacuum system enclosure and control panel.

Electrical conduit and wire will be run in a manner that meets or exceeds the NYC electrical code to the enclosure where the control panel will be located. A disconnect switch will be provided outside the enclosure which will serve as a local means of disconnect for emergency or maintenance use.

## **8. System Testing and Startup**

Prior to the startup of the SVE system, the vacuum blower and controls will be tested for correct operation, both electrically and mechanically.

LPC Developmet Group LLC  
August 8, 2017  
Page Four

Temporary sub-slab vacuum points (less than 6 in. deep) will be installed inside the basements at 333 and 345 Berry Street. A minimum of 6 temporary vacuum points will be installed to verify that adequate vacuum is reaching each of the points.

Each of the vacuum points will be connected to a hand-held digital manometer to check for vacuum influence. This vacuum influence will be used to demonstrate that the SVE system is providing adequate depressurization coverage.

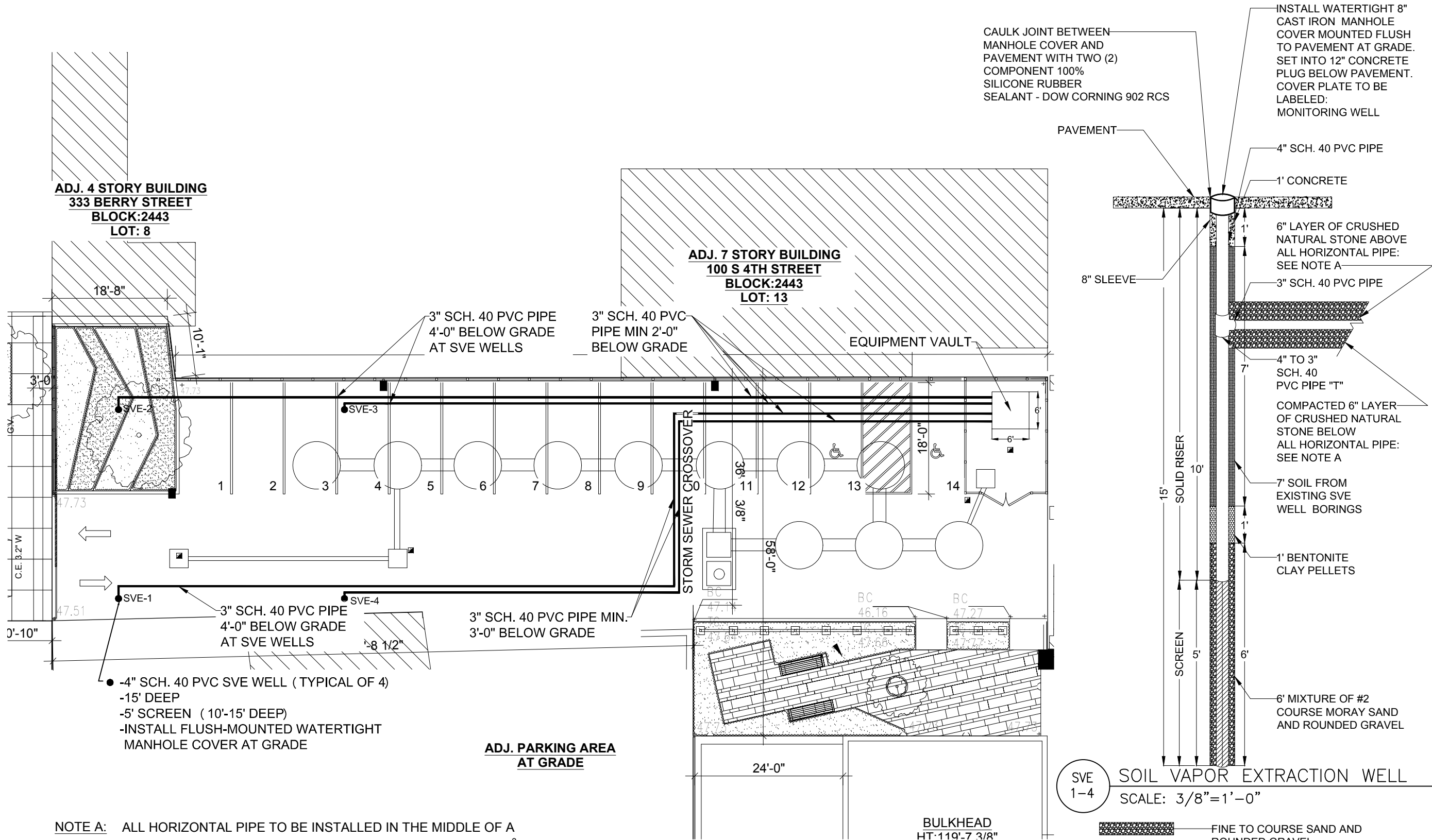
Following startup of the SVE system, the flow, vacuum, temperature and vapor concentrations in the influent and effluent will be monitored on a daily basis for the first 7 to 10 days and then monthly thereafter.

If you have any questions or require additional information, please do not hesitate to contact the undersigned.

Very truly yours,

A handwritten signature in black ink, appearing to read "P. P. Stewart", written in a cursive style.

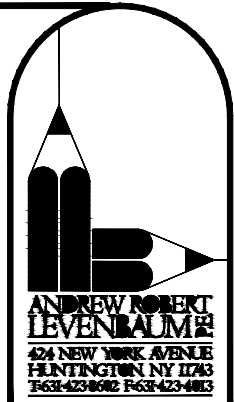
Paul P. Stewart, QEP  
President



**NOTE A:** ALL HORIZONTAL PIPE TO BE INSTALLED IN THE MIDDLE OF A 12" LAYER OF CRUSHED NATURAL BLUESTONE, MINIMUM OF  $\frac{3}{4}$ " SIZE, FREE OF ALL FRIABLE MATERIAL AND DEBRIS, GRADED IN ACCORDANCE WITH ASTM C136; ALL MATERIAL TO BE ABLE TO PASS THROUGH A 2" SEIVE.

**NOTE B:** SVE WELL QUANTITY AND LOCATIONS ARE SUBJECT TO PILOT WELL TESTING.

- FINE TO COURSE SAND AND ROUNDED GRAVEL
- BENTONITE PELLETS
- BANK RUN SAND AND GRAVEL
- CONCRETE
- SVE — SOIL VAPOR EXTRACTION WELL



STRUCTURAL CONSULTANT:  
MEPS CONSULTANT:

THE DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS PREPARED BY THE ARCHITECT AND PROFESSIONAL ENGINEER FOR THIS PROJECT ARE THE INSTRUMENTS OF THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S SERVICES FOR USE SOLELY WITH RESPECT TO THIS PROJECT AND, UNLESS OTHERWISE PROVIDED, THE ARCHITECT AND PROFESSIONAL ENGINEER SHALL BE DEEMED THE AUTHOR OF THESE DOCUMENTS AND SHALL RETAIN ALL COMMON LAW, STATUTORY AND OTHER RESERVED RIGHTS INCLUDING COPYRIGHT. THE OWNER SHALL BE PERMITTED TO RETAIN COPIES OF THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS FOR THE PROJECT. THE ARCHITECT'S AND PROFESSIONAL ENGINEER'S DRAWINGS SHALL NOT BE USED BY THE OWNER OR OTHERS ON OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR FOR COMPLETION OF THIS PROJECT BY OTHERS.

| NO | DESCRIPTION | DATE |
|----|-------------|------|
|    |             |      |
|    |             |      |
|    |             |      |
|    |             |      |

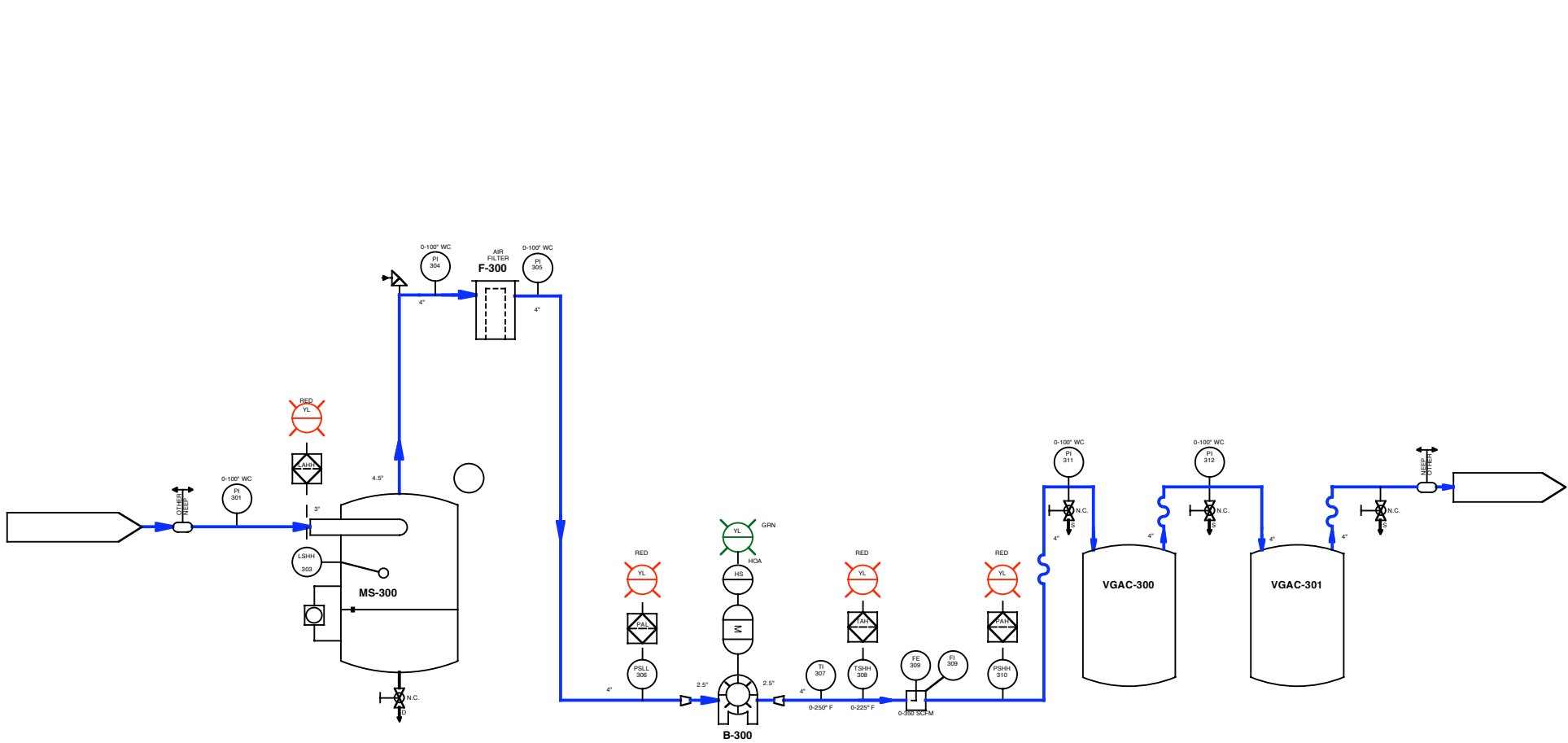
PROJECT DATA:  
**ALTERATIONS & ADDITIONS TO:**  
337 BERRY STREET  
BROOKLYN, NY, 11249

JOB NUMBER: 593

DOB BSCAN:

DRAWING TITLE:  
**SITE PLAN**

DRAWN BY: SCF  
CHECKED BY: ARL  
SCALE:  $\frac{1}{8}" = 1'-0"$   
DATE: 06.05.17  
**C-101.00**  
1 of 1



**TYPICAL P&ID**



## **Appendix F**

### **Groundwater Laboratory Tables**

Table 1  
Volatile Organic Compounds in Groundwater (ug/L)  
EPA Method 8260  
337 Berry Street Brooklyn, NY

| Sample ID<br>York ID<br>Sampling Date<br>Client Matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |             | NYSDEC TOGS<br>Standards and<br>Guidance<br>Values - GA | MW-1<br>19L1029-01<br>12/27/19<br>Water |   | MW-2<br>19L1029-02<br>12/27/19<br>Water |   | MW-3<br>19L1029-03<br>12/27/19<br>Water |   | Duplicate<br>19L1029-04<br>12/27/19<br>Water |   | Field Blank<br>19L1029-05<br>12/27/19<br>Water |   | Trip Blank<br>19L1029-06<br>12/27/19<br>Water |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------|-----------------------------------------|---|-----------------------------------------|---|-----------------------------------------|---|----------------------------------------------|---|------------------------------------------------|---|-----------------------------------------------|---|
| Compound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CAS Number  |                                                         | Result                                  | Q | Result                                  | Q | Result                                  | Q | Result                                       | Q | Result                                         | Q | Result                                        | Q |
| Volatile Organics, NJDEP/TCL/Part 375 List                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             | ug/L                                                    | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   | ug/L                                          |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             |                                                         | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   | 1                                             |   |
| 1,1,1,2-Tetrachloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 630-20-6    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,1,1-Trichloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 71-55-6     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.4                                     | J | 0.42                                         | J | 0.2                                            | U | 0.2                                           | U |
| 1,1,2,2-Tetrachloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 79-34-5     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 76-13-1     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,1,2-Trichloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 79-00-5     | 1                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,1-Dichloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 75-34-3     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,1-Dichloroethylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 75-35-4     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.38                                    | J | 0.4                                          | J | 0.2                                            | U | 0.2                                           | U |
| 1,2,3-Trichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 87-61-6     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2,3-Trichloropropane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 96-18-4     | 0.04                                                    | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2,4-Trichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 120-82-1    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2,4-Trimethylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 95-63-6     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2-Dibromo-3-chloropropane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 96-12-8     | 0.04                                                    | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2-Dibromoethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 106-93-4    | 0.0006                                                  | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2-Dichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 95-50-1     | 3                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2-Dichloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 107-06-2    | 0.6                                                     | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,2-Dichloropropane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 78-87-5     | 1                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,3,5-Trimethylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 108-67-8    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,3-Dichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 541-73-1    | 3                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,4-Dichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 106-46-7    | 3                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 1,4-Dioxane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 123-91-1    | ~                                                       | 40                                      | U | 40                                      | U | 40                                      | U | 40                                           | U | 40                                             | U | 40                                            | U |
| 2-Butanone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 78-93-3     | 50                                                      | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 2-Hexanone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 591-78-6    | 50                                                      | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| 4-Methyl-2-pentanone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 108-10-1    | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Acetone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 67-64-1     | 50                                                      | 1                                       | U | 1                                       | U | 1                                       | U | 1                                            | U | 1                                              | U | 1                                             | U |
| Acrolein                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 107-02-8    | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Acrylonitrile                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 107-13-1    | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Benzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 71-43-2     | 1                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Bromochloromethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 74-97-5     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Bromodichloromethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 75-27-4     | 50                                                      | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Bromoform                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 75-25-2     | 50                                                      | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Bromomethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 74-83-9     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Carbon disulfide                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 75-15-0     | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Carbon tetrachloride                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 56-23-5     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Chlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 108-90-7    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Chloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 75-00-3     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Chloroform                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 67-66-3     | 7                                                       | 3                                       |   | 0.2                                     | U | 1.4                                     |   | 1.4                                          |   | 0.2                                            | U | 0.2                                           | U |
| Chloromethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 74-87-3     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| cis-1,2-Dichloroethylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 156-59-2    | 5                                                       | 0.7                                     |   | 0.2                                     | U | 1.1                                     |   | 1.1                                          |   | 0.2                                            | U | 0.2                                           | U |
| cis-1,3-Dichloropropylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 10061-01-5  | 0.4                                                     | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Cyclohexane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 110-82-7    | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Dibromochloromethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 124-48-1    | 50                                                      | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Dibromomethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 74-95-3     | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Dichlorodifluoromethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 75-71-8     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Ethyl Benzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 100-41-4    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Hexachlorobutadiene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 87-68-3     | 0.5                                                     | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Isopropylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 98-82-8     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Methyl acetate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 79-20-9     | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Methyl tert-butyl ether (MTBE)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1634-04-4   | 10                                                      | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Methylcyclohexane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 108-87-2    | ~                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Methylene chloride                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 75-09-2     | 5                                                       | 1                                       | U | 1                                       | U | 1                                       | U | 1                                            | U | 1                                              | U | 1                                             | U |
| n-Butylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 104-51-8    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| n-Propylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 103-65-1    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| o-Xylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 95-47-6     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| p- & m- Xylenes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 179601-23-1 | 5                                                       | 0.5                                     | U | 0.5                                     | U | 0.5                                     | U | 0.5                                          | U | 0.5                                            | U | 0.5                                           | U |
| p-Isopropyltoluene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 99-87-6     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| sec-Butylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 135-98-8    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Styrene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 100-42-5    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| tert-Butyl alcohol (TBA)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 75-65-0     | ~                                                       | 0.5                                     | U | 0.5                                     | U | 0.5                                     | U | 0.5                                          | U | 0.5                                            | U | 0.5                                           | U |
| tert-Butylbenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 98-06-6     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Tetrachloroethylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 127-18-4    | 5                                                       | 50                                      |   | 9.6                                     |   | 16                                      |   | 9.1                                          |   | 0.2                                            | U | 0.2                                           | U |
| Toluene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 108-88-3    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| trans-1,2-Dichloroethylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 156-60-5    | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| trans-1,3-Dichloropropylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10061-02-6  | 0.4                                                     | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Trichloroethylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 79-01-6     | 5                                                       | 15                                      |   | 3.4                                     |   | 3                                       |   | 2.7                                          |   | 0.2                                            | U | 0.2                                           | U |
| Trichlorofluoromethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 75-69-4     | 5                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Vinyl Chloride                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 75-01-4     | 2                                                       | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | 0.2                                           | U |
| Xylenes, Total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1330-20-7   | 5                                                       | 0.6                                     | U | 0.6                                     | U | 0.6                                     | U | 0.6                                          | U | 0.6                                            | U | 0.6                                           | U |
| <b>NOTES:</b><br>Any Regulatory Exceedences are color coded by Regulation<br><br><b>Q is the Qualifier Column with definitions as follows:</b><br>D=result is from an analysis that required a dilution<br>J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated<br>U=analyte not detected at or above the level indicated<br>B=analyte found in the analysis batch blank<br>E=result is estimated and cannot be accurately reported due to levels encountered or interferences<br>P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis<br>NT=this indicates the analyte was not a target for this sample<br>~=this indicates that no regulatory limit has been established for this analyte |             |                                                         |                                         |   |                                         |   |                                         |   |                                              |   |                                                |   |                                               |   |

Table 2  
Semi Volatile Organic Compounds in Groundwater (ug/L)  
EPA Methods 8270D, 8270D SIM  
337 Berry Street, Brooklyn, NY

| Sample ID<br>York ID<br>Sampling Date<br>Client Matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            | NYSDEC TOGS<br>Standards and<br>Guidance<br>Values - GA | MW-1<br>19L1029-01<br>12/27/19<br>Water |   | MW-2<br>19L1029-02<br>12/27/19<br>Water |   | MW-3<br>19L1029-03<br>12/27/19<br>Water |   | Duplicate<br>19L1029-04<br>12/27/19<br>Water |   | Field Blank<br>19L1029-05<br>12/27/19<br>Water |   | Trip Blank<br>19L1029-06<br>12/27/19<br>Water |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------------------------------------------|-----------------------------------------|---|-----------------------------------------|---|-----------------------------------------|---|----------------------------------------------|---|------------------------------------------------|---|-----------------------------------------------|---|
| Compound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CAS Number |                                                         | Result                                  | Q | Result                                  | Q | Result                                  | Q | Result                                       | Q | Result                                         | Q | Result                                        | Q |
| SVOA, 8270 LOW MASTER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            | ug/L                                                    | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                         | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| 1,1-Biphenyl                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 92-52-4    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 1,2,4,5-Tetrachlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 95-94-3    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 1,2,4-Trichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 120-82-1   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 1,2-Dichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 95-50-1    | 3                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 1,2-Diphenylhydrazine (as Azobenzene)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 122-66-7   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 1,3-Dichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 541-73-1   | 3                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 1,4-Dichlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 106-46-7   | 3                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,3,4,6-Tetrachlorophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 58-90-2    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,4,5-Trichlorophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 95-95-4    | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,4,6-Trichlorophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 88-06-2    | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,4-Dichlorophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 120-83-2   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,4-Dimethylphenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 105-67-9   | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,4-Dinitrophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 51-28-5    | 10                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,4-Dinitrotoluene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 121-14-2   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2,6-Dinitrotoluene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 606-20-2   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2-Chloronaphthalene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 91-58-7    | 10                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2-Chlorophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 95-57-8    | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2-Methylnaphthalene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 91-57-6    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2-Methylphenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 95-48-7    | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2-Nitroaniline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 88-74-4    | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 2-Nitrophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 88-75-5    | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 3- & 4-Methylphenols                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 65794-96-9 | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 3,3-Dichlorobenzidine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 91-94-1    | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 3-Nitroaniline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 99-09-2    | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4,6-Dinitro-2-methylphenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 534-52-1   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4-Bromophenyl phenyl ether                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 101-55-3   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4-Chloro-3-methylphenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 59-50-7    | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4-Chloroaniline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 106-47-8   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4-Chlorophenyl phenyl ether                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7005-72-3  | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4-Nitroaniline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 100-01-6   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| 4-Nitrophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 100-02-7   | 1                                                       | 5                                       | U | 5                                       | U | 5.13                                    | U | 5.13                                         | U | 5.26                                           | U | NT                                            |   |
| Acetophenone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 98-86-2    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Aniline                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 62-53-3    | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Benzaldehyde                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 100-52-7   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Benzidine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 92-87-5    | ~                                                       | 5                                       | U | 5                                       | U | 5.13                                    | U | 5.13                                         | U | 5.26                                           | U | NT                                            |   |
| Benzoic acid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 65-85-0    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Benzyl alcohol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 100-51-6   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Benzyl butyl phthalate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 85-68-7    | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Bis(2-chloroethoxy)methane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 111-91-1   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Bis(2-chloroethyl)ether                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 111-44-4   | 1                                                       | 1                                       | U | 1                                       | U | 1.03                                    | U | 1.03                                         | U | 1.05                                           | U | NT                                            |   |
| Bis(2-chloroisopropyl)ether                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 108-60-1   | 5                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Caprolactam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 105-60-2   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Carbazole                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 86-74-8    | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Dibenzofuran                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 132-64-9   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Diethyl phthalate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 84-66-2    | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Dimethyl phthalate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 131-11-3   | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Di-n-butyl phthalate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 84-74-2    | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Di-n-octyl phthalate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 117-84-0   | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Hexachlorocyclopentadiene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 77-47-4    | 5                                                       | 5                                       | U | 5                                       | U | 5.13                                    | U | 5.13                                         | U | 5.26                                           | U | NT                                            |   |
| Isophorone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 78-59-1    | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| N-nitroso-di-n-propylamine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 621-64-7   | ~                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| N-Nitrosodiphenylamine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 86-30-6    | 50                                                      | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| Phenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 108-95-2   | 1                                                       | 2.5                                     | U | 2.5                                     | U | 2.56                                    | U | 2.56                                         | U | 2.63                                           | U | NT                                            |   |
| SVOA, 8270 SIM MASTER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            | ug/L                                                    | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                         | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Acenaphthene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 83-32-9    | 20                                                      | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Acenaphthylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 208-96-8   | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Anthracene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 120-12-7   | 50                                                      | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Atrazine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1912-24-9  | ~                                                       | 0.5                                     | U | 0.5                                     | U | 0.513                                   | U | 0.513                                        | U | 0.526                                          | U | NT                                            |   |
| Benzo(a)anthracene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 56-55-3    | 0.002                                                   | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Benzo(a)pyrene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 50-32-8    | 0.002                                                   | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Benzo(b)fluoranthene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 205-99-2   | 0.002                                                   | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Benzo(g,h,i)perylene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 191-24-2   | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Benzo(k)fluoranthene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 207-08-9   | 0.002                                                   | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Bis(2-ethylhexyl)phthalate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 117-81-7   | 5                                                       | <b>3.96</b>                             | B | <b>0.79</b>                             | B | 0.513                                   | U | 0.513                                        | U | 0.526                                          | U | NT                                            |   |
| Chrysene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 218-01-9   | 0.002                                                   | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Dibenzo(a,h)anthracene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 53-70-3    | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Fluoranthene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 206-44-0   | 50                                                      | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Fluorene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 86-73-7    | 50                                                      | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Hexachlorobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 118-74-1   | 0.04                                                    | 0.02                                    | U | 0.02                                    | U | 0.0205                                  | U | 0.0205                                       | U | 0.0211                                         | U | NT                                            |   |
| Hexachlorobutadiene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 87-68-3    | 0.5                                                     | 0.5                                     | U | 0.5                                     | U | 0.513                                   | U | 0.513                                        | U | 0.526                                          | U | NT                                            |   |
| Hexachloroethane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 67-72-1    | 5                                                       | 0.5                                     | U | 0.5                                     | U | 0.513                                   | U | 0.513                                        | U | 0.526                                          | U | NT                                            |   |
| Indeno(1,2,3-cd)pyrene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 193-39-5   | 0.002                                                   | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Naphthalene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 91-20-3    | 10                                                      | 0.05                                    | U | <b>0.05</b>                             |   | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Nitrobenzene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 98-95-3    | 0.4                                                     | 0.25                                    | U | 0.25                                    | U | 0.256                                   | U | 0.256                                        | U | 0.263                                          | U | NT                                            |   |
| N-Nitrosodimethylamine                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 62-75-9    | ~                                                       | 0.5                                     | U | 0.5                                     | U | 0.513                                   | U | 0.513                                        | U | 0.526                                          | U | NT                                            |   |
| Pentachlorophenol                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 87-86-5    | 1                                                       | 0.25                                    | U | 0.25                                    | U | 0.256                                   | U | 0.256                                        | U | 0.263                                          | U | NT                                            |   |
| Phenanthrene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 85-01-8    | 50                                                      | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| Pyrene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 129-00-0   | 50                                                      | 0.05                                    | U | 0.05                                    | U | 0.0513                                  | U | 0.0513                                       | U | 0.0526                                         | U | NT                                            |   |
| <b>NOTES:</b><br>Any Regulatory Exceedences are color coded by Regulation<br><br><b>Q is the Qualifier Column with definitions as follows:</b><br>D=result is from an analysis that required a dilution<br>J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated<br>U=analyte not detected at or above the level indicated<br>B=analyte found in the analysis batch blank<br>E=result is estimated and cannot be accurately reported due to levels encountered or interferences<br>P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis<br>NT=this indicates the analyte was not a target for this sample<br>~=this indicates that no regulatory limit has been established for this analyte |            |                                                         |                                         |   |                                         |   |                                         |   |                                              |   |                                                |   |                                               |   |

Table 3  
Pesticides and Polychlorinated Biphenyls in Groundwater (ug/L)  
EPA Methods 8081B and 8082A  
337 Berry Street, Brooklyn, NY

| Sample ID<br>York ID<br>Sampling Date<br>Client Matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            | NYSDEC TOGS<br>Standards and<br>Guidance<br>Values - GA | MW-1<br>19L1029-01<br>12/27/19<br>Water |   | MW-2<br>19L1029-02<br>12/27/19<br>Water |   | MW-3<br>19L1029-03<br>12/27/19<br>Water |   | Duplicate<br>19L1029-04<br>12/27/19<br>Water |   | Field Blank<br>19L1029-05<br>12/27/19<br>Water |   | Trip Blank<br>19L1029-06<br>12/27/19<br>Water |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|---------------------------------------------------------|-----------------------------------------|---|-----------------------------------------|---|-----------------------------------------|---|----------------------------------------------|---|------------------------------------------------|---|-----------------------------------------------|---|
| Compound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CAS Number |                                                         | Result                                  | Q | Result                                  | Q | Result                                  | Q | Result                                       | Q | Result                                         | Q | Result                                        | Q |
| PEST, 8081 MASTER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | ug/L                                                    | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                         | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| 4,4'-DDD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 72-54-8    | 0.3                                                     | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| 4,4'-DDE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 72-55-9    | 0.2                                                     | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| 4,4'-DDT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 50-29-3    | 0.2                                                     | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Aldrin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 309-00-2   | ~                                                       | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| alpha-BHC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 319-84-6   | 0.01                                                    | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| alpha-Chlordane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5103-71-9  | ~                                                       | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| beta-BHC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 319-85-7   | 0.04                                                    | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Chlordane, total                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 57-74-9    | 0.05                                                    | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.205                                        | U | 0.2                                            | U | NT                                            |   |
| delta-BHC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 319-86-8   | 0.04                                                    | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Dieldrin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 60-57-1    | 0.004                                                   | 0.002                                   | U | 0.002                                   | U | 0.002                                   | U | 0.00205                                      | U | 0.002                                          | U | NT                                            |   |
| Endosulfan I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 959-98-8   | ~                                                       | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Endosulfan II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 33213-65-9 | ~                                                       | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Endosulfan sulfate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1031-07-8  | ~                                                       | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Endrin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 72-20-8    | ~                                                       | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Endrin aldehyde                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 7421-93-4  | 5                                                       | 0.01                                    | U | 0.01                                    | U | 0.01                                    | U | 0.0103                                       | U | 0.01                                           | U | NT                                            |   |
| Endrin ketone                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 53494-70-5 | 5                                                       | 0.01                                    | U | 0.01                                    | U | 0.01                                    | U | 0.0103                                       | U | 0.01                                           | U | NT                                            |   |
| gamma-BHC (Lindane)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 58-89-9    | 0.05                                                    | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| gamma-Chlordane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5566-34-7  | ~                                                       | 0.01                                    | U | 0.01                                    | U | 0.01                                    | U | 0.0103                                       | U | 0.01                                           | U | NT                                            |   |
| Heptachlor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 76-44-8    | 0.04                                                    | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Heptachlor epoxide                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1024-57-3  | 0.03                                                    | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Methoxychlor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 72-43-5    | 35                                                      | 0.004                                   | U | 0.004                                   | U | 0.004                                   | U | 0.0041                                       | U | 0.004                                          | U | NT                                            |   |
| Toxaphene                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 8001-35-2  | 0.06                                                    | 0.1                                     | U | 0.1                                     | U | 0.1                                     | U | 0.103                                        | U | 0.1                                            | U | NT                                            |   |
| Polychlorinated Biphenyls (PCB)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            | ug/L                                                    | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                         | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Aroclor 1016                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 12674-11-2 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Aroclor 1221                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11104-28-2 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Aroclor 1232                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11141-16-5 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Aroclor 1242                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 53469-21-9 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Aroclor 1248                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 12672-29-6 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Aroclor 1254                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11097-69-1 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Aroclor 1260                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11096-82-5 | ~                                                       | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| Total PCBs                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1336-36-3  | 0.09                                                    | 0.05                                    | U | 0.05                                    | U | 0.05                                    | U | 0.0513                                       | U | 0.05                                           | U | NT                                            |   |
| <b>NOTES:</b><br>Any Regulatory Exceedences are color coded by Regulation<br><br><b>Q is the Qualifier Column with definitions as follows:</b><br>D=result is from an analysis that required a dilution<br>J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated<br>U=analyte not detected at or above the level indicated<br>B=analyte found in the analysis batch blank<br>E=result is estimated and cannot be accurately reported due to levels encountered or interferences<br>P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis<br>NT=this indicates the analyte was not a target for this sample<br>~=this indicates that no regulatory limit has been established for this analyte |            |                                                         |                                         |   |                                         |   |                                         |   |                                              |   |                                                |   |                                               |   |

Table 4  
Metals in Groundwater (ug/L)  
EPA Methods 6010D, 6020B, and 7473  
337 Berry Street, Brooklyn, NY

| Sample ID<br>York ID<br>Sampling Date<br>Client Matrix                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            | NYSDEC TOGS<br>Standards and<br>Guidance<br><br>Values - GA | MW-1<br>19L1029-01<br>12/27/19<br>Water |   | MW-2<br>19L1029-02<br>12/27/19<br>Water |   | MW-3<br>19L1029-03<br>12/27/19<br>Water |   | Duplicate<br>19L1029-04<br>12/27/19<br>Water |   | Field Blank<br>19L1029-05<br>12/27/19<br>Water |   | Trip Blank<br>19L1029-06<br>12/27/19<br>Water |   |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-------------------------------------------------------------|-----------------------------------------|---|-----------------------------------------|---|-----------------------------------------|---|----------------------------------------------|---|------------------------------------------------|---|-----------------------------------------------|---|
| Compound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | CAS Number |                                                             | Result                                  | Q | Result                                  | Q | Result                                  | Q | Result                                       | Q | Result                                         | Q | Result                                        | Q |
| Metals, Target Analyte, ICP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | ug/L                                                        | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                             | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Aluminum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7429-90-5  | ~                                                           | 149                                     |   | 120                                     |   | 458                                     |   | 182                                          |   | 55.6                                           | U | NT                                            |   |
| Barium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-39-3  | 1000                                                        | 81.9                                    |   | 28.4                                    |   | 71.4                                    |   | 70                                           |   | 27.8                                           | U | NT                                            |   |
| Calcium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7440-70-2  | ~                                                           | 91200                                   |   | 34500                                   |   | 78700                                   |   | 80100                                        |   | 55.6                                           | U | NT                                            |   |
| Chromium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-47-3  | 50                                                          | 5.56                                    | U | 5.56                                    | U | 5.56                                    | U | 5.56                                         | U | 5.56                                           | U | NT                                            |   |
| Cobalt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-48-4  | ~                                                           | 4.44                                    | U | 4.44                                    | U | 4.44                                    | U | 4.44                                         | U | 4.44                                           | U | NT                                            |   |
| Copper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-50-8  | 200                                                         | 22.2                                    | U | 22.2                                    | U | 22.2                                    | U | 22.2                                         | U | 22.2                                           | U | NT                                            |   |
| Iron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7439-89-6  | ~                                                           | 278                                     | U | 278                                     | U | 715                                     |   | 436                                          |   | 278                                            | U | NT                                            |   |
| Lead                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7439-92-1  | 25                                                          | 5.56                                    | U | 5.56                                    | U | 5.56                                    | U | 5.56                                         | U | 5.56                                           | U | NT                                            |   |
| Magnesium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7439-95-4  | 35000                                                       | 32200                                   |   | 7090                                    |   | 26000                                   |   | 26000                                        |   | 55.6                                           | U | NT                                            |   |
| Manganese                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7439-96-5  | 300                                                         | 51                                      |   | 6.56                                    |   | 31                                      |   | 20.3                                         |   | 5.56                                           | U | NT                                            |   |
| Nickel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-02-0  | 100                                                         | 11.1                                    | U | 11.1                                    | U | 11.1                                    | U | 11.1                                         | U | 11.1                                           | U | NT                                            |   |
| Potassium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7440-09-7  | ~                                                           | 4940                                    |   | 1530                                    |   | 2920                                    |   | 2920                                         |   | 55.6                                           | U | NT                                            |   |
| Silver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-22-4  | 50                                                          | 5.56                                    | U | 5.56                                    | U | 5.56                                    | U | 5.56                                         | U | 5.56                                           | U | NT                                            |   |
| Sodium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-23-5  | 20000                                                       | 94800                                   |   | 4910                                    |   | 75800                                   |   | 74300                                        |   | 556                                            | U | NT                                            |   |
| Vanadium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-62-2  | ~                                                           | 11.1                                    | U | 11.1                                    | U | 11.1                                    | U | 11.1                                         | U | 11.1                                           | U | NT                                            |   |
| Zinc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7440-66-6  | 2000                                                        | 27.8                                    | U | 27.8                                    | U | 27.8                                    | U | 27.8                                         | U | 27.8                                           | U | NT                                            |   |
| Metals, Target Analyte, ICP Dissolved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            | ug/L                                                        | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                             | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Aluminum                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7429-90-5  | ~                                                           | 55.6                                    | U | 55.6                                    | U | 55.6                                    | U | 55.6                                         | U | 55.6                                           | U | NT                                            |   |
| Barium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-39-3  | 1000                                                        | 79.8                                    |   | 27.8                                    |   | 67.6                                    |   | 67.1                                         |   | 27.8                                           | U | NT                                            |   |
| Calcium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7440-70-2  | ~                                                           | 90200                                   |   | 33900                                   |   | 78400                                   |   | 79200                                        |   | 55.6                                           | U | NT                                            |   |
| Chromium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-47-3  | 50                                                          | 5.56                                    | U | 5.56                                    | U | 5.56                                    | U | 5.56                                         | U | 5.56                                           | U | NT                                            |   |
| Cobalt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-48-4  | ~                                                           | 4.44                                    | U | 4.44                                    | U | 4.44                                    | U | 4.44                                         | U | 4.44                                           | U | NT                                            |   |
| Copper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-50-8  | 200                                                         | 22.2                                    | U | 22.2                                    | U | 22.2                                    | U | 22.2                                         | U | 22.2                                           | U | NT                                            |   |
| Iron                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7439-89-6  | ~                                                           | 278                                     | U | 278                                     | U | 278                                     | U | 278                                          | U | 278                                            | U | NT                                            |   |
| Lead                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7439-92-1  | 25                                                          | 5.56                                    | U | 5.56                                    | U | 5.56                                    | U | 5.56                                         | U | 5.56                                           | U | NT                                            |   |
| Magnesium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7439-95-4  | 35000                                                       | 31700                                   |   | 6860                                    |   | 25300                                   |   | 25200                                        |   | 55.6                                           | U | NT                                            |   |
| Manganese                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7439-96-5  | 300                                                         | 40.8                                    |   | 5.56                                    | U | 17.8                                    |   | 10.1                                         |   | 5.56                                           | U | NT                                            |   |
| Nickel                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-02-0  | 100                                                         | 11.1                                    | U | 11.1                                    | U | 11.1                                    | U | 11.1                                         | U | 11.1                                           | U | NT                                            |   |
| Potassium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7440-09-7  | ~                                                           | 5260                                    |   | 1620                                    |   | 2990                                    |   | 3020                                         |   | 55.6                                           | U | NT                                            |   |
| Silver                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-22-4  | 50                                                          | 5.56                                    | U | 5.56                                    | U | 5.56                                    | U | 5.56                                         | U | 5.56                                           | U | NT                                            |   |
| Sodium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 7440-23-5  | 20000                                                       | 95700                                   |   | 4960                                    |   | 74700                                   |   | 75200                                        |   | 556                                            | U | NT                                            |   |
| Vanadium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-62-2  | ~                                                           | 11.1                                    | U | 11.1                                    | U | 11.1                                    | U | 11.1                                         | U | 11.1                                           | U | NT                                            |   |
| Zinc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7440-66-6  | 2000                                                        | 27.8                                    | U | 27.8                                    | U | 27.8                                    | U | 27.8                                         | U | 27.8                                           | U | NT                                            |   |
| Metals, Target Analyte, ICPMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            | ug/L                                                        | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                             | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Antimony                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-36-0  | 3                                                           | 1.11                                    | U | 1.11                                    | U | 1.11                                    | U | 1.11                                         | U | 1.11                                           | U | NT                                            |   |
| Arsenic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7440-38-2  | 25                                                          | 1.11                                    | U | 1.11                                    | U | 1.11                                    | U | 1.11                                         | U | 1.11                                           | U | NT                                            |   |
| Beryllium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7440-41-7  | 3                                                           | 0.333                                   | U | 0.333                                   | U | 0.333                                   | U | 0.333                                        | U | 0.333                                          | U | NT                                            |   |
| Cadmium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7440-43-9  | 5                                                           | 0.556                                   | U | 0.556                                   | U | 0.556                                   | U | 0.556                                        | U | 0.556                                          | U | NT                                            |   |
| Selenium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7782-49-2  | 10                                                          | 4.87                                    |   | 1.11                                    | U | 6.03                                    |   | 6.46                                         |   | 1.11                                           | U | NT                                            |   |
| Thallium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-28-0  | ~                                                           | 1.11                                    | U | 1.11                                    | U | 1.11                                    | U | 1.11                                         | U | 1.11                                           | U | NT                                            |   |
| Metals, Target Analyte, ICPMS Dissolved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            | ug/L                                                        | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                             | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Antimony                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-36-0  | 3                                                           | 1.11                                    | U | 1.11                                    | U | 1.11                                    | U | 1.11                                         | U | 1.11                                           | U | NT                                            |   |
| Arsenic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7440-38-2  | 25                                                          | 1.11                                    | U | 1.11                                    | U | 1.11                                    | U | 1.11                                         | U | 1.11                                           | U | NT                                            |   |
| Beryllium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 7440-41-7  | 3                                                           | 0.333                                   | U | 0.333                                   | U | 0.333                                   | U | 0.333                                        | U | 0.333                                          | U | NT                                            |   |
| Cadmium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7440-43-9  | 5                                                           | 0.556                                   | U | 0.556                                   | U | 0.556                                   | U | 0.556                                        | U | 0.556                                          | U | NT                                            |   |
| Selenium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7782-49-2  | 10                                                          | 5.41                                    |   | 1.11                                    | U | 4.69                                    |   | 6.33                                         |   | 1.11                                           | U | NT                                            |   |
| Thallium                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 7440-28-0  | ~                                                           | 1.11                                    | U | 1.11                                    | U | 1.11                                    | U | 1.11                                         | U | 1.11                                           | U | NT                                            |   |
| Mercury by 7473                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            | ug/L                                                        | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                             | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Mercury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7439-97-6  | 0.7                                                         | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | NT                                            |   |
| Mercury by 7473, Dissolved                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | ug/L                                                        | ug/L                                    |   | ug/L                                    |   | ug/L                                    |   | ug/L                                         |   | ug/L                                           |   |                                               |   |
| Dilution Factor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                             | 1                                       |   | 1                                       |   | 1                                       |   | 1                                            |   | 1                                              |   |                                               |   |
| Mercury                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7439-97-6  | 0.7                                                         | 0.2                                     | U | 0.2                                     | U | 0.2                                     | U | 0.2                                          | U | 0.2                                            | U | NT                                            |   |
| <b>NOTES:</b><br>Any Regulatory Exceedences are color coded by Regulation<br><br><b>Q is the Qualifier Column with definitions as follows:</b><br>D=result is from an analysis that required a dilution<br>J=analyte detected at or above the MDL (method detection limit) but below the RL (Reporting Limit) - data is estimated<br>U=analyte not detected at or above the level indicated<br>B=analyte found in the analysis batch blank<br>E=result is estimated and cannot be accurately reported due to levels encountered or interferences<br>P=this flag is used for pesticide and PCB (Aroclor) target compounds when there is a % difference for detected concentrations that exceed method dictated limits between the two GC columns used for analysis<br>NT=this indicates the analyte was not a target for this sample<br>~=this indicates that no regulatory limit has been established for this analyte |            |                                                             |                                         |   |                                         |   |                                         |   |                                              |   |                                                |   |                                               |   |

## **Appendix G**

### **Groundwater Laboratory Tables**



# Technical Report

prepared for:

**Advanced Cleanup Technologies, Inc.**  
110 Main Street  
Port Washington NY, 11050  
**Attention: Paul Stewart**

Report Date: 01/07/2020  
**Client Project ID: 9311-BKNY**  
York Project (SDG) No.: 19L1029

CT Cert. No. PH-0723

New Jersey Cert. No. CT005 and NY037



New York Cert. Nos. 10854 and 12058

PA Cert. No. 68-04440

120 RESEARCH DRIVE  
[www.YORKLAB.com](http://www.YORKLAB.com)

STRATFORD, CT 06615  
(203) 325-1371

132-02 89th AVENUE  
FAX (203) 357-0166

RICHMOND HILL, NY 11418  
[ClientServices@yorklab.com](mailto:ClientServices@yorklab.com)

Report Date: 01/07/2020  
Client Project ID: 9311-BKNY  
York Project (SDG) No.: 19L1029

**Advanced Cleanup Technologies, Inc.**  
110 Main Street  
Port Washington NY, 11050  
Attention: Paul Stewart

---

## Purpose and Results

This report contains the analytical data for the sample(s) identified on the attached chain-of-custody received in our laboratory on December 30, 2019 with a temperature of 1.9 C. The project was identified as your project: **9311-BKNY**.

The analyses were conducted utilizing appropriate EPA, Standard Methods, and ASTM methods as detailed in the data summary tables.

All samples were received in proper condition meeting the customary acceptance requirements for environmental samples except those indicated under the Sample and Analysis Qualifiers section of this report.

All analyses met the method and laboratory standard operating procedure requirements except as indicated by any data flags, the meaning of which are explained in the Sample and Data Qualifiers Relating to This Work Order section of this report and case narrative if applicable.

The results of the analyses, which are all reported on dry weight basis (soils) unless otherwise noted, are detailed in the following pages.

Please contact Client Services at 203.325.1371 with any questions regarding this report.

| <u>York Sample ID</u> | <u>Client Sample ID</u> | <u>Matrix</u> | <u>Date Collected</u> | <u>Date Received</u> |
|-----------------------|-------------------------|---------------|-----------------------|----------------------|
| 19L1029-01            | MW-1                    | Water         | 12/27/2019            | 12/30/2019           |
| 19L1029-02            | MW-2                    | Water         | 12/27/2019            | 12/30/2019           |
| 19L1029-03            | MW-3                    | Water         | 12/27/2019            | 12/30/2019           |
| 19L1029-04            | Duplicate               | Water         | 12/27/2019            | 12/30/2019           |
| 19L1029-05            | Field Blank             | Water         | 12/27/2019            | 12/30/2019           |
| 19L1029-06            | Trip Blank              | Water         | 12/27/2019            | 12/30/2019           |



## **General Notes for York Project (SDG) No.: 19L1029**

1. The RLs and MDLs (Reporting Limit and Method Detection Limit respectively) reported are adjusted for any dilution necessary due to the levels of target and/or non-target analytes and matrix interference. The RL(REPORTING LIMIT) is based upon the lowest standard utilized for the calibration where applicable.
2. Samples are retained for a period of thirty days after submittal of report, unless other arrangements are made.
3. York's liability for the above data is limited to the dollar value paid to York for the referenced project.
4. This report shall not be reproduced without the written approval of York Analytical Laboratories, Inc.
5. All analyses conducted met method or Laboratory SOP requirements. See the Sample and Data Qualifiers Section for further information.
6. It is noted that no analyses reported herein were subcontracted to another laboratory, unless noted in the report.
7. This report reflects results that relate only to the samples submitted on the attached chain-of-custody form(s) received by York.
8. Analyses conducted at York Analytical Laboratories, Inc. Stratford, CT are indicated by NY Cert. No. 10854; those conducted at York Analytical Laboratories, Inc., Richmond Hill, NY are indicated by NY Cert. No. 12058.

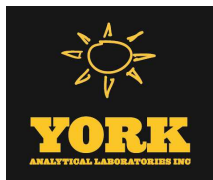
**Approved By:**



**Benjamin Gulizia**  
Laboratory Director

**Date:** 01/07/2020





## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

**York Project (SDG) No.**

**Client Project ID**

**Matrix**

**Collection Date/Time**

**Date Received**

19L1029

9311-BKNY

Water

December 27, 2019 1:45 pm

12/30/2019

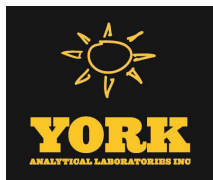
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.  | Parameter                                            | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------------------|--------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 630-20-6 | 1,1,1,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 71-55-6  | 1,1,1-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 79-34-5  | 1,1,2,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 76-13-1  | 1,1,2-Trichloro-1,2,2-trifluoroethane<br>(Freon 113) | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 79-00-5  | 1,1,2-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-34-3  | 1,1-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-35-4  | 1,1-Dichloroethylene                                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 87-61-6  | 1,2,3-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 96-18-4  | 1,2,3-Trichloropropane                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 120-82-1 | 1,2,4-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 95-63-6  | 1,2,4-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 96-12-8  | 1,2-Dibromo-3-chloropropane                          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 106-93-4 | 1,2-Dibromoethane                                    | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 95-50-1  | 1,2-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 107-06-2 | 1,2-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 78-87-5  | 1,2-Dichloropropane                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 108-67-8 | 1,3,5-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 541-73-1 | 1,3-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 106-46-7 | 1,4-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 123-91-1 | 1,4-Dioxane                                          | ND     |      | ug/L  | 40                     | 80   | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.    | Parameter                       | Result      | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|---------------------------------|-------------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 78-93-3    | 2-Butanone                      | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 591-78-6   | 2-Hexanone                      | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 108-10-1   | 4-Methyl-2-pentanone            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 67-64-1    | Acetone                         | ND          |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 107-02-8   | Acrolein                        | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 107-13-1   | Acrylonitrile                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 71-43-2    | Benzene                         | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 74-97-5    | Bromochloromethane              | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-27-4    | Bromodichloromethane            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-25-2    | Bromoform                       | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 74-83-9    | Bromomethane                    | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-15-0    | Carbon disulfide                | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 56-23-5    | Carbon tetrachloride            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 108-90-7   | Chlorobenzene                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-00-3    | Chloroethane                    | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 67-66-3    | <b>Chloroform</b>               | <b>3.0</b>  |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 74-87-3    | Chloromethane                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 156-59-2   | <b>cis-1,2-Dichloroethylene</b> | <b>0.70</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 10061-01-5 | cis-1,3-Dichloropropylene       | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 110-82-7   | Cyclohexane                     | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 124-48-1   | Dibromochloromethane            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 74-95-3    | Dibromomethane                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.     | Parameter                      | Result    | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-------------|--------------------------------|-----------|-------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-71-8     | Dichlorodifluoromethane        | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 100-41-4    | Ethyl Benzene                  | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 87-68-3     | Hexachlorobutadiene            | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 98-82-8     | Isopropylbenzene               | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 79-20-9     | Methyl acetate                 | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 1634-04-4   | Methyl tert-butyl ether (MTBE) | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 108-87-2    | Methylcyclohexane              | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-09-2     | Methylene chloride             | ND        |       | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 104-51-8    | n-Butylbenzene                 | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 103-65-1    | n-Propylbenzene                | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 95-47-6     | o-Xylene                       | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 179601-23-1 | p- & m- Xylenes                | ND        |       | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 99-87-6     | p-Isopropyltoluene             | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 135-98-8    | sec-Butylbenzene               | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 100-42-5    | Styrene                        | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-65-0     | tert-Butyl alcohol (TBA)       | ND        |       | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 98-06-6     | tert-Butylbenzene              | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 127-18-4    | <b>Tetrachloroethylene</b>     | <b>50</b> | CCV-E | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 108-88-3    | Toluene                        | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 156-60-5    | trans-1,2-Dichloroethylene     | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 10061-02-6  | trans-1,3-Dichloropropylene    | ND        |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 79-01-6     | <b>Trichloroethylene</b>       | <b>15</b> |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 1:45 pm

**Date Received**  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.                     | Parameter                                 | Result        | Flag | Units | Reported to<br>LOD/MDL  | LOQ  | Dilution | Reference Method                                                  | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|-------------------------------------------|---------------|------|-------|-------------------------|------|----------|-------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-69-4                     | Trichlorofluoromethane                    | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 75-01-4                     | Vinyl Chloride                            | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| 1330-20-7                   | Xylenes, Total                            | ND            |      | ug/L  | 0.60                    | 1.5  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,NJ | 01/02/2020 06:28      | 01/02/2020 17:52      | LLJ     |
| <b>Surrogate Recoveries</b> |                                           | <b>Result</b> |      |       | <b>Acceptance Range</b> |      |          |                                                                   |                       |                       |         |
| 17060-07-0                  | Surrogate: SURR:<br>1,2-Dichloroethane-d4 | 99.5 %        |      |       | 69-130                  |      |          |                                                                   |                       |                       |         |
| 2037-26-5                   | Surrogate: SURR: Toluene-d8               | 95.4 %        |      |       | 81-117                  |      |          |                                                                   |                       |                       |         |
| 460-00-4                    | Surrogate: SURR:<br>p-Bromofluorobenzene  | 96.4 %        |      |       | 79-122                  |      |          |                                                                   |                       |                       |         |

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-52-4  | 1,1-Biphenyl                             | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 95-94-3  | 1,2,4,5-Tetrachlorobenzene               | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 120-82-1 | 1,2,4-Trichlorobenzene                   | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 95-50-1  | 1,2-Dichlorobenzene                      | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 122-66-7 | 1,2-Diphenylhydrazine (as<br>Azobenzene) | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 541-73-1 | 1,3-Dichlorobenzene                      | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 106-46-7 | 1,4-Dichlorobenzene                      | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 58-90-2  | 2,3,4,6-Tetrachlorophenol                | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 95-95-4  | 2,4,5-Trichlorophenol                    | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 88-06-2  | 2,4,6-Trichlorophenol                    | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 120-83-2 | 2,4-Dichlorophenol                       | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 105-67-9 | 2,4-Dimethylphenol                       | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 51-28-5  | 2,4-Dinitrophenol                        | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

**SVOA, 8270 Low NJDEP/TCL/Part 375**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 3510C

| CAS No.    | Parameter                   | Result | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|-----------------------------|--------|-------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 121-14-2   | 2,4-Dinitrotoluene          | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 606-20-2   | 2,6-Dinitrotoluene          | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 91-58-7    | 2-Chloronaphthalene         | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 95-57-8    | 2-Chlorophenol              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 91-57-6    | 2-Methylnaphthalene         | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 95-48-7    | 2-Methylphenol              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 88-74-4    | 2-Nitroaniline              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 88-75-5    | 2-Nitrophenol               | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 65794-96-9 | 3- & 4-Methylphenols        | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 91-94-1    | 3,3-Dichlorobenzidine       | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 99-09-2    | 3-Nitroaniline              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 534-52-1   | 4,6-Dinitro-2-methylphenol  | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 101-55-3   | 4-Bromophenyl phenyl ether  | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 59-50-7    | 4-Chloro-3-methylphenol     | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 106-47-8   | 4-Chloroaniline             | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 7005-72-3  | 4-Chlorophenyl phenyl ether | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 100-01-6   | 4-Nitroaniline              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 100-02-7   | 4-Nitrophenol               | ND     |       | ug/L  | 5.00                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 98-86-2    | Acetophenone                | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 62-53-3    | Aniline                     | ND     | CCV-L | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 100-52-7   | Benzaldehyde                | ND     | CCV-L | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

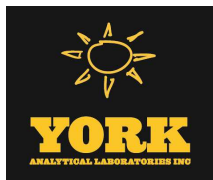
### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.              | Parameter                        | Result | Flag             | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------------------|----------------------------------|--------|------------------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-87-5              | Benzidine                        | ND     | CCV-L            | ug/L  | 5.00                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 65-85-0              | Benzoic acid                     | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 100-51-6             | Benzyl alcohol                   | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 85-68-7              | Benzyl butyl phthalate           | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 111-91-1             | Bis(2-chloroethoxy)methane       | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 111-44-4             | Bis(2-chloroethyl)ether          | ND     |                  | ug/L  | 1.00                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 108-60-1             | Bis(2-chloroisopropyl)ether      | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 105-60-2             | Caprolactam                      | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 86-74-8              | Carbazole                        | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 132-64-9             | Dibenzofuran                     | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 84-66-2              | Diethyl phthalate                | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 131-11-3             | Dimethyl phthalate               | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 84-74-2              | Di-n-butyl phthalate             | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 117-84-0             | Di-n-octyl phthalate             | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 77-47-4              | Hexachlorocyclopentadiene        | ND     |                  | ug/L  | 5.00                   | 10.0 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 78-59-1              | Isophorone                       | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 621-64-7             | N-nitroso-di-n-propylamine       | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 86-30-6              | N-Nitrosodiphenylamine           | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| 108-95-2             | Phenol                           | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:58      | OW      |
| Surrogate Recoveries |                                  | Result | Acceptance Range |       |                        |      |          |                                                              |                       |                       |         |
| 367-12-4             | Surrogate: SURR: 2-Fluorophenol  | 41.6 % | 19.7-63.1        |       |                        |      |          |                                                              |                       |                       |         |
| 4165-62-2            | Surrogate: SURR: Phenol-d5       | 26.9 % | 10.1-41.7        |       |                        |      |          |                                                              |                       |                       |         |
| 4165-60-0            | Surrogate: SURR: Nitrobenzene-d5 | 69.8 % | 50.2-113         |       |                        |      |          |                                                              |                       |                       |         |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|------------------------------------------|--------|------|-------|------------------------|-----|----------|------------------|-----------------------|-----------------------|---------|
| 321-60-8  | Surrogate: SURR: 2-Fluorobiphenyl        | 72.5 % |      |       | 39.9-105               |     |          |                  |                       |                       |         |
| 118-79-6  | Surrogate: SURR:<br>2,4,6-Tribromophenol | 92.3 % |      |       | 39.3-151               |     |          |                  |                       |                       |         |
| 1718-51-0 | Surrogate: SURR: Terphenyl-d14           | 79.1 % |      |       | 30.7-106               |     |          |                  |                       |                       |         |

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                         | Result      | Flag     | Units | Reported to<br>LOQ | Dilution | Reference Method                                                 | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------------------------------|-------------|----------|-------|--------------------|----------|------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 83-32-9   | Acenaphthene                      | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 208-96-8  | Acenaphthylene                    | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 120-12-7  | Anthracene                        | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 1912-24-9 | Atrazine                          | ND          |          | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 56-55-3   | Benzo(a)anthracene                | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 50-32-8   | Benzo(a)pyrene                    | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 205-99-2  | Benzo(b)fluoranthene              | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 191-24-2  | Benzo(g,h,i)perylene              | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 207-08-9  | Benzo(k)fluoranthene              | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 117-81-7  | <b>Bis(2-ethylhexyl)phthalate</b> | <b>3.96</b> | <b>B</b> | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 218-01-9  | Chrysene                          | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 53-70-3   | Dibenzo(a,h)anthracene            | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 206-44-0  | Fluoranthene                      | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 86-73-7   | Fluorene                          | ND          |          | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 118-74-1  | Hexachlorobenzene                 | ND          |          | ug/L  | 0.0200             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 87-68-3   | Hexachlorobutadiene               | ND          |          | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 67-72-1   | Hexachloroethane                  | ND          |          | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |





## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter              | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                                 | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------|--------|------|-------|--------------------|----------|------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 193-39-5 | Indeno(1,2,3-cd)pyrene | ND     |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 91-20-3  | Naphthalene            | ND     |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 98-95-3  | Nitrobenzene           | ND     |      | ug/L  | 0.250              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 62-75-9  | N-Nitrosodimethylamine | ND     |      | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 87-86-5  | Pentachlorophenol      | ND     |      | ug/L  | 0.250              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 85-01-8  | Phenanthrene           | ND     |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |
| 129-00-0 | Pyrene                 | ND     |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 15:33      | OW      |

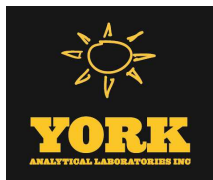
### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter          | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|--------------------|--------|------|-------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 72-54-8    | 4,4'-DDD           | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 72-55-9    | 4,4'-DDE           | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 50-29-3    | 4,4'-DDT           | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 309-00-2   | Aldrin             | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 319-84-6   | alpha-BHC          | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 5103-71-9  | alpha-Chlordane    | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 319-85-7   | beta-BHC           | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 319-86-8   | delta-BHC          | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 60-57-1    | Dieldrin           | ND     |      | ug/L  | 0.00200            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 959-98-8   | Endosulfan I       | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 33213-65-9 | Endosulfan II      | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |
| 1031-07-8  | Endosulfan sulfate | ND     |      | ug/L  | 0.00400            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 08:12      | CM      |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-20-8                     | Endrin                          | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 7421-93-4                   | Endrin aldehyde                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 53494-70-5                  | Endrin ketone                   | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 58-89-9                     | gamma-BHC (Lindane)             | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 5566-34-7                   | gamma-Chlordane                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 76-44-8                     | Heptachlor                      | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 1024-57-3                   | Heptachlor epoxide              | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 72-43-5                     | Methoxychlor                    | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 8001-35-2                   | Toxaphene                       | ND            |      | ug/L                    | 0.100           | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| 57-74-9                     | * Chlordane, total              | ND            |      | ug/L                    | 0.200           | 1        | EPA 8081B<br>Certifications:                                 | 01/02/2020 08:33   | 01/05/2020 08:12   | CM      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                 |          |                                                              |                    |                    |         |
| 2051-24-3                   | Surrogate: Decachlorobiphenyl   | 95.1 %        |      |                         |                 |          |                                                              |                    |                    |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 174 %         | S-GC |                         |                 |          |                                                              |                    |                    |         |

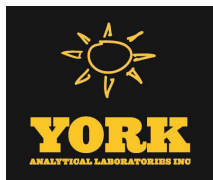
### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter    | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 12674-11-2 | Aroclor 1016 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| 11104-28-2 | Aroclor 1221 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| 11141-16-5 | Aroclor 1232 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| 53469-21-9 | Aroclor 1242 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| 12672-29-6 | Aroclor 1248 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| 11097-69-1 | Aroclor 1254 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| 11096-82-5 | Aroclor 1260 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 1:45 pm

**Date Received**  
12/30/2019

### Polychlorinated Biphenyls (PCB)

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.              | Parameter                       | Result | Flag             | Units | Reported to LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------------------|---------------------------------|--------|------------------|-------|-----------------|----------|------------------|--------------------|--------------------|---------|
| 1336-36-3            | * Total PCBs                    | ND     |                  | ug/L  | 0.0500          | 1        | EPA 8082A        | 01/02/2020 08:33   | 01/02/2020 19:32   | SR      |
| Certifications:      |                                 |        |                  |       |                 |          |                  |                    |                    |         |
| Surrogate Recoveries |                                 | Result | Acceptance Range |       |                 |          |                  |                    |                    |         |
| 877-09-8             | Surrogate: Tetrachloro-m-xylene | 90.0 % | 30-120           |       |                 |          |                  |                    |                    |         |
| 2051-24-3            | Surrogate: Decachlorobiphenyl   | 98.0 % | 30-120           |       |                 |          |                  |                    |                    |         |

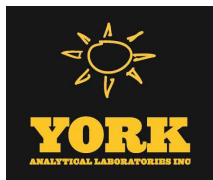
### Metals, Target Analyte, ICP

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method | Date/Time Prepared              | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|------------------|---------------------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | 0.149  |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-39-3 | Barium    | 0.0819 |      | mg/L  | 0.0278          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-70-2 | Calcium   | 91.2   |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444         | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7439-89-6 | Iron      | ND     |      | mg/L  | 0.278           | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7439-95-4 | Magnesium | 32.2   |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7439-96-5 | Manganese | 0.0510 |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-09-7 | Potassium | 4.94   |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-23-5 | Sodium    | 94.8   |      | mg/L  | 0.556           | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D        | 12/31/2019 18:46                | 01/02/2020 14:22   | JAM     |
|           |           |        |      |       |                 |          | Certifications:  | CTDOH,NELAC-NY10854,NJDEP,PADEP |                    |         |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 1:45 pm

Date Received  
12/30/2019

### Metals, Target Analyte, ICP Dissolved

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-39-3 | Barium    | 0.0798 |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-70-2 | Calcium   | 90.2   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7439-89-6 | Iron      | ND     |      | mg/L  | 0.278           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7439-95-4 | Magnesium | 31.7   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7439-96-5 | Manganese | 0.0408 |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-09-7 | Potassium | 5.26   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-23-5 | Sodium    | 95.7   |      | mg/L  | 0.556           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:26   | JAM     |

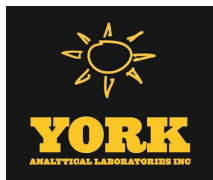
### Metals, Target Analyte, ICPMS

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:30   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:30   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:30   | BML     |



## Sample Information

**Client Sample ID:** MW-1

**York Sample ID:** 19L1029-01

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 1:45 pm

**Date Received**  
12/30/2019

### Metals, Target Analyte, ICPMS

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:30   | BML     |
| 7782-49-2 | Selenium  | 4.87   |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:30   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:30   | BML     |

### Metals, Target Analyte, ICPMS Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:43   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:43   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:43   | BML     |
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:43   | BML     |
| 7782-49-2 | Selenium  | 5.41   |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:43   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:43   | BML     |

### Mercury by 7473

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.00020         | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/30/2019 16:35   | 12/30/2019 19:22   | MAO     |

### Mercury by 7473, Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.000200        | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 11:39   | 01/02/2020 14:01   | SY      |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

**York Project (SDG) No.**

19L1029

**Client Project ID**

9311-BKNY

**Matrix**

Water

**Collection Date/Time**

December 27, 2019 12:15 pm

**Date Received**

12/30/2019

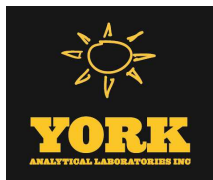
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.  | Parameter                                            | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------------------|--------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 630-20-6 | 1,1,1,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 71-55-6  | 1,1,1-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 79-34-5  | 1,1,2,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 76-13-1  | 1,1,2-Trichloro-1,2,2-trifluoroethane<br>(Freon 113) | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 79-00-5  | 1,1,2-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-34-3  | 1,1-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-35-4  | 1,1-Dichloroethylene                                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 87-61-6  | 1,2,3-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 96-18-4  | 1,2,3-Trichloropropane                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 120-82-1 | 1,2,4-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 95-63-6  | 1,2,4-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 96-12-8  | 1,2-Dibromo-3-chloropropane                          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 106-93-4 | 1,2-Dibromoethane                                    | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 95-50-1  | 1,2-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 107-06-2 | 1,2-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 78-87-5  | 1,2-Dichloropropane                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 108-67-8 | 1,3,5-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 541-73-1 | 1,3-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 106-46-7 | 1,4-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 123-91-1 | 1,4-Dioxane                                          | ND     |      | ug/L  | 40                     | 80   | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 78-93-3  | 2-Butanone                                           | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

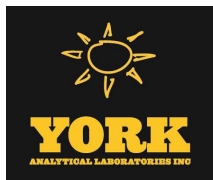
### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.    | Parameter                 | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|---------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 591-78-6   | 2-Hexanone                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 108-10-1   | 4-Methyl-2-pentanone      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 67-64-1    | Acetone                   | ND     |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 107-02-8   | Acrolein                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 107-13-1   | Acrylonitrile             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 71-43-2    | Benzene                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 74-97-5    | Bromochloromethane        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-27-4    | Bromodichloromethane      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-25-2    | Bromoform                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 74-83-9    | Bromomethane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-15-0    | Carbon disulfide          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 56-23-5    | Carbon tetrachloride      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 108-90-7   | Chlorobenzene             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-00-3    | Chloroethane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 67-66-3    | Chloroform                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 74-87-3    | Chloromethane             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 156-59-2   | cis-1,2-Dichloroethylene  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 10061-01-5 | cis-1,3-Dichloropropylene | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 110-82-7   | Cyclohexane               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 124-48-1   | Dibromochloromethane      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 74-95-3    | Dibromomethane            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |





## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

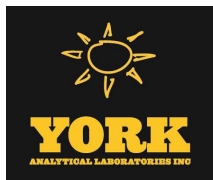
### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.     | Parameter                      | Result     | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-------------|--------------------------------|------------|-------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-71-8     | Dichlorodifluoromethane        | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIC | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 100-41-4    | Ethyl Benzene                  | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 87-68-3     | Hexachlorobutadiene            | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIC | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 98-82-8     | Isopropylbenzene               | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 79-20-9     | Methyl acetate                 | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIC | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 1634-04-4   | Methyl tert-butyl ether (MTBE) | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 108-87-2    | Methylcyclohexane              | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIC | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-09-2     | Methylene chloride             | ND         |       | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 104-51-8    | n-Butylbenzene                 | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 103-65-1    | n-Propylbenzene                | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 95-47-6     | o-Xylene                       | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 179601-23-1 | p- & m- Xylenes                | ND         |       | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 99-87-6     | p-Isopropyltoluene             | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 135-98-8    | sec-Butylbenzene               | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 100-42-5    | Styrene                        | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-65-0     | tert-Butyl alcohol (TBA)       | ND         |       | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIC | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 98-06-6     | tert-Butylbenzene              | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 127-18-4    | <b>Tetrachloroethylene</b>     | <b>9.6</b> | CCV-E | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 108-88-3    | Toluene                        | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 156-60-5    | trans-1,2-Dichloroethylene     | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 10061-02-6  | trans-1,3-Dichloropropylene    | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 79-01-6     | <b>Trichloroethylene</b>       | <b>3.4</b> |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |





## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:15 pm

**Date Received**  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.                     | Parameter                                 | Result        | Flag | Units | Reported to<br>LOD/MDL  | LOQ  | Dilution | Reference Method                                                  | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|-------------------------------------------|---------------|------|-------|-------------------------|------|----------|-------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-69-4                     | Trichlorofluoromethane                    | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 75-01-4                     | Vinyl Chloride                            | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| 1330-20-7                   | Xylenes, Total                            | ND            |      | ug/L  | 0.60                    | 1.5  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,NJ | 01/02/2020 06:28      | 01/02/2020 18:18      | LLJ     |
| <b>Surrogate Recoveries</b> |                                           | <b>Result</b> |      |       | <b>Acceptance Range</b> |      |          |                                                                   |                       |                       |         |
| 17060-07-0                  | Surrogate: SURR:<br>1,2-Dichloroethane-d4 | 105 %         |      |       | 69-130                  |      |          |                                                                   |                       |                       |         |
| 2037-26-5                   | Surrogate: SURR: Toluene-d8               | 95.0 %        |      |       | 81-117                  |      |          |                                                                   |                       |                       |         |
| 460-00-4                    | Surrogate: SURR:<br>p-Bromofluorobenzene  | 93.6 %        |      |       | 79-122                  |      |          |                                                                   |                       |                       |         |

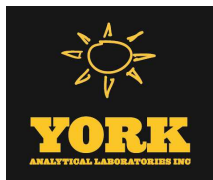
### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-52-4  | 1,1-Biphenyl                             | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 95-94-3  | 1,2,4,5-Tetrachlorobenzene               | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 120-82-1 | 1,2,4-Trichlorobenzene                   | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 95-50-1  | 1,2-Dichlorobenzene                      | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 122-66-7 | 1,2-Diphenylhydrazine (as<br>Azobenzene) | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 541-73-1 | 1,3-Dichlorobenzene                      | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 106-46-7 | 1,4-Dichlorobenzene                      | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 58-90-2  | 2,3,4,6-Tetrachlorophenol                | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 95-95-4  | 2,4,5-Trichlorophenol                    | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 88-06-2  | 2,4,6-Trichlorophenol                    | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 120-83-2 | 2,4-Dichlorophenol                       | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 105-67-9 | 2,4-Dimethylphenol                       | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 51-28-5  | 2,4-Dinitrophenol                        | ND     |      | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

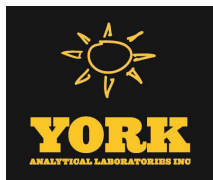
### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.    | Parameter                   | Result | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|-----------------------------|--------|-------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 121-14-2   | 2,4-Dinitrotoluene          | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 606-20-2   | 2,6-Dinitrotoluene          | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 91-58-7    | 2-Chloronaphthalene         | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 95-57-8    | 2-Chlorophenol              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 91-57-6    | 2-Methylnaphthalene         | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 95-48-7    | 2-Methylphenol              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 88-74-4    | 2-Nitroaniline              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 88-75-5    | 2-Nitrophenol               | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 65794-96-9 | 3- & 4-Methylphenols        | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 91-94-1    | 3,3-Dichlorobenzidine       | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 99-09-2    | 3-Nitroaniline              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 534-52-1   | 4,6-Dinitro-2-methylphenol  | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 101-55-3   | 4-Bromophenyl phenyl ether  | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 59-50-7    | 4-Chloro-3-methylphenol     | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 106-47-8   | 4-Chloroaniline             | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 7005-72-3  | 4-Chlorophenyl phenyl ether | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 100-01-6   | 4-Nitroaniline              | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 100-02-7   | 4-Nitrophenol               | ND     |       | ug/L  | 5.00                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 98-86-2    | Acetophenone                | ND     |       | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 62-53-3    | Aniline                     | ND     | CCV-L | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 100-52-7   | Benzaldehyde                | ND     | CCV-L | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

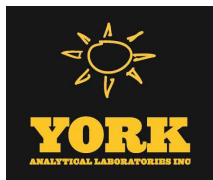
### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.              | Parameter                        | Result | Flag             | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------------------|----------------------------------|--------|------------------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-87-5              | Benzidine                        | ND     | CCV-L            | ug/L  | 5.00                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 65-85-0              | Benzoic acid                     | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 100-51-6             | Benzyl alcohol                   | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 85-68-7              | Benzyl butyl phthalate           | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 111-91-1             | Bis(2-chloroethoxy)methane       | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 111-44-4             | Bis(2-chloroethyl)ether          | ND     |                  | ug/L  | 1.00                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 108-60-1             | Bis(2-chloroisopropyl)ether      | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 105-60-2             | Caprolactam                      | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 86-74-8              | Carbazole                        | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 132-64-9             | Dibenzofuran                     | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 84-66-2              | Diethyl phthalate                | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 131-11-3             | Dimethyl phthalate               | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 84-74-2              | Di-n-butyl phthalate             | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 117-84-0             | Di-n-octyl phthalate             | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 77-47-4              | Hexachlorocyclopentadiene        | ND     |                  | ug/L  | 5.00                   | 10.0 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 78-59-1              | Isophorone                       | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 621-64-7             | N-nitroso-di-n-propylamine       | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 86-30-6              | N-Nitrosodiphenylamine           | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| 108-95-2             | Phenol                           | ND     |                  | ug/L  | 2.50                   | 5.00 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 18:34      | OW      |
| Surrogate Recoveries |                                  | Result | Acceptance Range |       |                        |      |          |                                                              |                       |                       |         |
| 367-12-4             | Surrogate: SURR: 2-Fluorophenol  | 39.8 % | 19.7-63.1        |       |                        |      |          |                                                              |                       |                       |         |
| 4165-62-2            | Surrogate: SURR: Phenol-d5       | 27.5 % | 10.1-41.7        |       |                        |      |          |                                                              |                       |                       |         |
| 4165-60-0            | Surrogate: SURR: Nitrobenzene-d5 | 69.3 % | 50.2-113         |       |                        |      |          |                                                              |                       |                       |         |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|------------------------------------------|--------|------|-------|------------------------|-----|----------|------------------|-----------------------|-----------------------|---------|
| 321-60-8  | Surrogate: SURR: 2-Fluorobiphenyl        | 70.2 % |      |       | 39.9-105               |     |          |                  |                       |                       |         |
| 118-79-6  | Surrogate: SURR:<br>2,4,6-Tribromophenol | 89.4 % |      |       | 39.3-151               |     |          |                  |                       |                       |         |
| 1718-51-0 | Surrogate: SURR: Terphenyl-d14           | 74.0 % |      |       | 30.7-106               |     |          |                  |                       |                       |         |

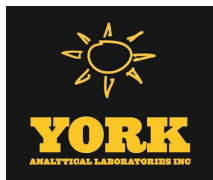
### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                         | Result       | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                                 | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------------------------------|--------------|------|-------|--------------------|----------|------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 83-32-9   | Acenaphthene                      | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 208-96-8  | Acenaphthylene                    | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 120-12-7  | Anthracene                        | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 1912-24-9 | Atrazine                          | ND           |      | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 56-55-3   | Benzo(a)anthracene                | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 50-32-8   | Benzo(a)pyrene                    | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 205-99-2  | Benzo(b)fluoranthene              | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 191-24-2  | Benzo(g,h,i)perylene              | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 207-08-9  | Benzo(k)fluoranthene              | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 117-81-7  | <b>Bis(2-ethylhexyl)phthalate</b> | <b>0.790</b> | B    | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 218-01-9  | Chrysene                          | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 53-70-3   | Dibenzo(a,h)anthracene            | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 206-44-0  | Fluoranthene                      | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 86-73-7   | Fluorene                          | ND           |      | ug/L  | 0.0500             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 118-74-1  | Hexachlorobenzene                 | ND           |      | ug/L  | 0.0200             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 87-68-3   | Hexachlorobutadiene               | ND           |      | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |
| 67-72-1   | Hexachloroethane                  | ND           |      | ug/L  | 0.500              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:04      | OW      |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter              | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                                 | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------|------------------------|--------|------|-------|-----------------|----------|------------------------------------------------------------------|--------------------|--------------------|---------|
| 193-39-5 | Indeno(1,2,3-cd)pyrene | ND     |      | ug/L  | 0.0500          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |
| 91-20-3  | Naphthalene            | 0.0500 |      | ug/L  | 0.0500          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |
| 98-95-3  | Nitrobenzene           | ND     |      | ug/L  | 0.250           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |
| 62-75-9  | N-Nitrosodimethylamine | ND     |      | ug/L  | 0.500           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |
| 87-86-5  | Pentachlorophenol      | ND     |      | ug/L  | 0.250           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |
| 85-01-8  | Phenanthrene           | ND     |      | ug/L  | 0.0500          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |
| 129-00-0 | Pyrene                 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 16:04   | OW      |

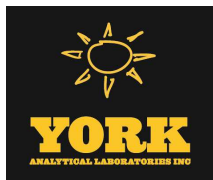
### Pesticides, NJDEP/TCL/Part 375 List

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter          | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-54-8    | 4,4'-DDD           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 72-55-9    | 4,4'-DDE           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 50-29-3    | 4,4'-DDT           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 309-00-2   | Aldrin             | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 319-84-6   | alpha-BHC          | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 5103-71-9  | alpha-Chlordane    | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 319-85-7   | beta-BHC           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 319-86-8   | delta-BHC          | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 60-57-1    | Dieldrin           | ND     |      | ug/L  | 0.00200         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 959-98-8   | Endosulfan I       | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 33213-65-9 | Endosulfan II      | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 1031-07-8  | Endosulfan sulfate | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-20-8                     | Endrin                          | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 7421-93-4                   | Endrin aldehyde                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 53494-70-5                  | Endrin ketone                   | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 58-89-9                     | gamma-BHC (Lindane)             | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 5566-34-7                   | gamma-Chlordane                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 76-44-8                     | Heptachlor                      | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 1024-57-3                   | Heptachlor epoxide              | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 72-43-5                     | Methoxychlor                    | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 8001-35-2                   | Toxaphene                       | ND            |      | ug/L                    | 0.100           | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| 57-74-9                     | * Chlordane, total              | ND            |      | ug/L                    | 0.200           | 1        | EPA 8081B<br>Certifications:                                 | 01/02/2020 08:33   | 01/05/2020 08:30   | CM      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                 |          |                                                              |                    |                    |         |
| 2051-24-3                   | Surrogate: Decachlorobiphenyl   | 107 %         |      |                         |                 |          |                                                              |                    |                    |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 201 %         | S-GC |                         |                 |          |                                                              |                    |                    |         |

### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter    | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 12674-11-2 | Aroclor 1016 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| 11104-28-2 | Aroclor 1221 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| 11141-16-5 | Aroclor 1232 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| 53469-21-9 | Aroclor 1242 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| 12672-29-6 | Aroclor 1248 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| 11097-69-1 | Aroclor 1254 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| 11096-82-5 | Aroclor 1260 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |



## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:15 pm

**Date Received**  
12/30/2019

### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.              | Parameter                       | Result | Flag | Units            | Reported to LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------------------|---------------------------------|--------|------|------------------|-----------------|----------|------------------|--------------------|--------------------|---------|
| 1336-36-3            | * Total PCBs                    | ND     |      | ug/L             | 0.0500          | 1        | EPA 8082A        | 01/02/2020 08:33   | 01/02/2020 19:46   | SR      |
| Surrogate Recoveries |                                 | Result |      | Acceptance Range |                 |          |                  |                    |                    |         |
| 877-09-8             | Surrogate: Tetrachloro-m-xylene | 104 %  |      | 30-120           |                 |          |                  |                    |                    |         |
| 2051-24-3            | Surrogate: Decachlorobiphenyl   | 130 %  | S-HI | 30-120           |                 |          |                  |                    |                    |         |

### Metals, Target Analyte, ICP

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result                                          | Flag | Units | Reported to LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|-------------------------------------------------|------|-------|-----------------|----------|------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | 0.120                                           |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-39-3 | Barium    | 0.0284                                          |      | mg/L  | 0.0278          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-70-2 | Calcium   | 34.5                                            |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-47-3 | Chromium  | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-48-4 | Cobalt    | ND                                              |      | mg/L  | 0.00444         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-50-8 | Copper    | ND                                              |      | mg/L  | 0.0222          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-89-6 | Iron      | ND                                              |      | mg/L  | 0.278           | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-92-1 | Lead      | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-95-4 | Magnesium | 7.09                                            |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-96-5 | Manganese | 0.00656                                         |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-02-0 | Nickel    | ND                                              |      | mg/L  | 0.0111          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-09-7 | Potassium | 1.53                                            |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-22-4 | Silver    | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-23-5 | Sodium    | 4.91                                            |      | mg/L  | 0.556           | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-62-2 | Vanadium  | ND                                              |      | mg/L  | 0.0111          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-66-6 | Zinc      | ND                                              |      | mg/L  | 0.0278          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:25   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |





## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:15 pm

Date Received  
12/30/2019

### Metals, Target Analyte, ICP Dissolved

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-39-3 | Barium    | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-70-2 | Calcium   | 33.9   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7439-89-6 | Iron      | ND     |      | mg/L  | 0.278           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7439-95-4 | Magnesium | 6.86   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7439-96-5 | Manganese | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-09-7 | Potassium | 1.62   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-23-5 | Sodium    | 4.96   |      | mg/L  | 0.556           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:29   | JAM     |

### Metals, Target Analyte, ICPMS

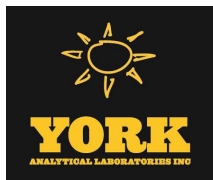
### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:46   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:46   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:46   | BML     |





## Sample Information

**Client Sample ID:** MW-2

**York Sample ID:** 19L1029-02

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:15 pm

**Date Received**  
12/30/2019

### Metals, Target Analyte, ICPMS

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:46   | BML     |
| 7782-49-2 | Selenium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:46   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:46   | BML     |

### Metals, Target Analyte, ICPMS Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:59   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:59   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:59   | BML     |
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:59   | BML     |
| 7782-49-2 | Selenium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:59   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 15:59   | BML     |

### Mercury by 7473

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.00020         | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/30/2019 16:35   | 12/30/2019 20:02   | MAO     |

### Mercury by 7473, Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.000200        | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 11:39   | 01/02/2020 15:06   | SY      |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 10:05 am

**Date Received**  
12/30/2019

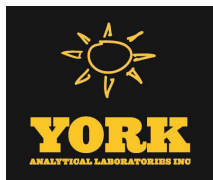
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.  | Parameter                                            | Result      | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------------------|-------------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 630-20-6 | 1,1,1,2-Tetrachloroethane                            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 71-55-6  | <b>1,1,1-Trichloroethane</b>                         | <b>0.40</b> | J    | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 79-34-5  | 1,1,2,2-Tetrachloroethane                            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 76-13-1  | 1,1,2-Trichloro-1,2,2-trifluoroethane<br>(Freon 113) | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 79-00-5  | 1,1,2-Trichloroethane                                | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-34-3  | 1,1-Dichloroethane                                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-35-4  | <b>1,1-Dichloroethylene</b>                          | <b>0.38</b> | J    | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 87-61-6  | 1,2,3-Trichlorobenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 96-18-4  | 1,2,3-Trichloropropane                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 120-82-1 | 1,2,4-Trichlorobenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 95-63-6  | 1,2,4-Trimethylbenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 96-12-8  | 1,2-Dibromo-3-chloropropane                          | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 106-93-4 | 1,2-Dibromoethane                                    | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 95-50-1  | 1,2-Dichlorobenzene                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 107-06-2 | 1,2-Dichloroethane                                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 78-87-5  | 1,2-Dichloropropane                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 108-67-8 | 1,3,5-Trimethylbenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 541-73-1 | 1,3-Dichlorobenzene                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 106-46-7 | 1,4-Dichlorobenzene                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 123-91-1 | 1,4-Dioxane                                          | ND          |      | ug/L  | 40                     | 80   | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 78-93-3  | 2-Butanone                                           | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

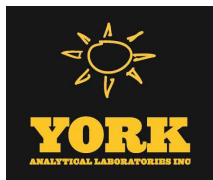
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.    | Parameter                       | Result     | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|---------------------------------|------------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 591-78-6   | 2-Hexanone                      | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 108-10-1   | 4-Methyl-2-pentanone            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 67-64-1    | Acetone                         | ND         |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 107-02-8   | Acrolein                        | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 107-13-1   | Acrylonitrile                   | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 71-43-2    | Benzene                         | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 74-97-5    | Bromochloromethane              | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-27-4    | Bromodichloromethane            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-25-2    | Bromoform                       | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 74-83-9    | Bromomethane                    | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-15-0    | Carbon disulfide                | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 56-23-5    | Carbon tetrachloride            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 108-90-7   | Chlorobenzene                   | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-00-3    | Chloroethane                    | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 67-66-3    | <b>Chloroform</b>               | <b>1.4</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 74-87-3    | Chloromethane                   | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 156-59-2   | <b>cis-1,2-Dichloroethylene</b> | <b>1.1</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 10061-01-5 | cis-1,3-Dichloropropylene       | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 110-82-7   | Cyclohexane                     | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 124-48-1   | Dibromochloromethane            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 74-95-3    | Dibromomethane                  | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-71-8    | Dichlorodifluoromethane         | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

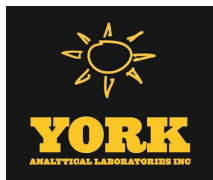
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.     | Parameter                      | Result     | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-------------|--------------------------------|------------|-------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 100-41-4    | Ethyl Benzene                  | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 87-68-3     | Hexachlorobutadiene            | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 98-82-8     | Isopropylbenzene               | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 79-20-9     | Methyl acetate                 | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 1634-04-4   | Methyl tert-butyl ether (MTBE) | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 108-87-2    | Methylcyclohexane              | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-09-2     | Methylene chloride             | ND         |       | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 104-51-8    | n-Butylbenzene                 | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 103-65-1    | n-Propylbenzene                | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 95-47-6     | o-Xylene                       | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 179601-23-1 | p- & m- Xylenes                | ND         |       | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 99-87-6     | p-Isopropyltoluene             | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 135-98-8    | sec-Butylbenzene               | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 100-42-5    | Styrene                        | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-65-0     | tert-Butyl alcohol (TBA)       | ND         |       | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 98-06-6     | tert-Butylbenzene              | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 127-18-4    | <b>Tetrachloroethylene</b>     | <b>16</b>  | CCV-E | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 108-88-3    | Toluene                        | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 156-60-5    | trans-1,2-Dichloroethylene     | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 10061-02-6  | trans-1,3-Dichloropropylene    | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 79-01-6     | <b>Trichloroethylene</b>       | <b>3.0</b> |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 75-69-4     | Trichlorofluoromethane         | ND         |       | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.                     | Parameter                                 | Result        | Flag | Units | Reported to<br>LOD/MDL  | LOQ  | Dilution | Reference Method                                                  | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|-------------------------------------------|---------------|------|-------|-------------------------|------|----------|-------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-01-4                     | Vinyl Chloride                            | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| 1330-20-7                   | Xylenes, Total                            | ND            |      | ug/L  | 0.60                    | 1.5  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,NJ | 01/02/2020 06:28      | 01/02/2020 18:45      | LLJ     |
| <b>Surrogate Recoveries</b> |                                           | <b>Result</b> |      |       | <b>Acceptance Range</b> |      |          |                                                                   |                       |                       |         |
| 17060-07-0                  | Surrogate: SURR:<br>1,2-Dichloroethane-d4 | 99.6 %        |      |       | 69-130                  |      |          |                                                                   |                       |                       |         |
| 2037-26-5                   | Surrogate: SURR: Toluene-d8               | 96.1 %        |      |       | 81-117                  |      |          |                                                                   |                       |                       |         |
| 460-00-4                    | Surrogate: SURR:<br>p-Bromofluorobenzene  | 92.0 %        |      |       | 79-122                  |      |          |                                                                   |                       |                       |         |

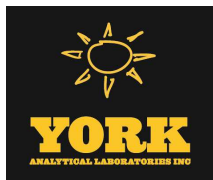
### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-52-4  | 1,1-Biphenyl                             | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 95-94-3  | 1,2,4,5-Tetrachlorobenzene               | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 120-82-1 | 1,2,4-Trichlorobenzene                   | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 95-50-1  | 1,2-Dichlorobenzene                      | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 122-66-7 | 1,2-Diphenylhydrazine (as<br>Azobenzene) | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 541-73-1 | 1,3-Dichlorobenzene                      | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 106-46-7 | 1,4-Dichlorobenzene                      | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 58-90-2  | 2,3,4,6-Tetrachlorophenol                | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 95-95-4  | 2,4,5-Trichlorophenol                    | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 88-06-2  | 2,4,6-Trichlorophenol                    | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 120-83-2 | 2,4-Dichlorophenol                       | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 105-67-9 | 2,4-Dimethylphenol                       | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 51-28-5  | 2,4-Dinitrophenol                        | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 121-14-2 | 2,4-Dinitrotoluene                       | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

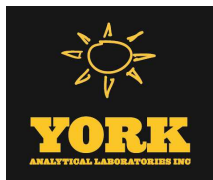
**SVOA, 8270 Low NJDEP/TCL/Part 375**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 3510C

| CAS No.    | Parameter                   | Result | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|-----------------------------|--------|-------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 606-20-2   | 2,6-Dinitrotoluene          | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 91-58-7    | 2-Chloronaphthalene         | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 95-57-8    | 2-Chlorophenol              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 91-57-6    | 2-Methylnaphthalene         | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 95-48-7    | 2-Methylphenol              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 88-74-4    | 2-Nitroaniline              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 88-75-5    | 2-Nitrophenol               | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 65794-96-9 | 3- & 4-Methylphenols        | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 91-94-1    | 3,3-Dichlorobenzidine       | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 99-09-2    | 3-Nitroaniline              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 534-52-1   | 4,6-Dinitro-2-methylphenol  | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 101-55-3   | 4-Bromophenyl phenyl ether  | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 59-50-7    | 4-Chloro-3-methylphenol     | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 106-47-8   | 4-Chloroaniline             | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 7005-72-3  | 4-Chlorophenyl phenyl ether | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 100-01-6   | 4-Nitroaniline              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 100-02-7   | 4-Nitrophenol               | ND     |       | ug/L  | 5.13                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 98-86-2    | Acetophenone                | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 62-53-3    | Aniline                     | ND     | CCV-L | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 100-52-7   | Benzaldehyde                | ND     | CCV-L | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 92-87-5    | Benzidine                   | ND     | CCV-L | ug/L  | 5.13                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

**SVOA, 8270 Low NJDEP/TCL/Part 375**

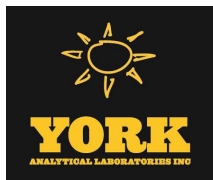
**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 3510C

| CAS No.                     | Parameter                                | Result        | Flag                    | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|------------------------------------------|---------------|-------------------------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 65-85-0                     | Benzoic acid                             | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 100-51-6                    | Benzyl alcohol                           | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 85-68-7                     | Benzyl butyl phthalate                   | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 111-91-1                    | Bis(2-chloroethoxy)methane               | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 111-44-4                    | Bis(2-chloroethyl)ether                  | ND            |                         | ug/L  | 1.03                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 108-60-1                    | Bis(2-chloroisopropyl)ether              | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 105-60-2                    | Caprolactam                              | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 86-74-8                     | Carbazole                                | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 132-64-9                    | Dibenzofuran                             | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 84-66-2                     | Diethyl phthalate                        | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 131-11-3                    | Dimethyl phthalate                       | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 84-74-2                     | Di-n-butyl phthalate                     | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 117-84-0                    | Di-n-octyl phthalate                     | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 77-47-4                     | Hexachlorocyclopentadiene                | ND            |                         | ug/L  | 5.13                   | 10.3 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 78-59-1                     | Isophorone                               | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 621-64-7                    | N-nitroso-di-n-propylamine               | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 86-30-6                     | N-Nitrosodiphenylamine                   | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| 108-95-2                    | Phenol                                   | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:05      | OW      |
| <b>Surrogate Recoveries</b> |                                          | <b>Result</b> | <b>Acceptance Range</b> |       |                        |      |          |                                                              |                       |                       |         |
| 367-12-4                    | Surrogate: SURR: 2-Fluorophenol          | 40.0 %        | 19.7-63.1               |       |                        |      |          |                                                              |                       |                       |         |
| 4165-62-2                   | Surrogate: SURR: Phenol-d5               | 26.0 %        | 10.1-41.7               |       |                        |      |          |                                                              |                       |                       |         |
| 4165-60-0                   | Surrogate: SURR: Nitrobenzene-d5         | 70.7 %        | 50.2-113                |       |                        |      |          |                                                              |                       |                       |         |
| 321-60-8                    | Surrogate: SURR: 2-Fluorobiphenyl        | 67.2 %        | 39.9-105                |       |                        |      |          |                                                              |                       |                       |         |
| 118-79-6                    | Surrogate: SURR:<br>2,4,6-Tribromophenol | 91.3 %        | 39.3-151                |       |                        |      |          |                                                              |                       |                       |         |





## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                      | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|--------------------------------|--------|------|-------|------------------------|-----|----------|------------------|-----------------------|-----------------------|---------|
| 1718-51-0 | Surrogate: SURR: Terphenyl-d14 | 78.0 % |      |       | 30.7-106               |     |          |                  |                       |                       |         |

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                  | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                                 | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|----------------------------|--------|------|-------|--------------------|----------|------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 83-32-9   | Acenaphthene               | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 208-96-8  | Acenaphthylene             | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 120-12-7  | Anthracene                 | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 1912-24-9 | Atrazine                   | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 56-55-3   | Benzo(a)anthracene         | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 50-32-8   | Benzo(a)pyrene             | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 205-99-2  | Benzo(b)fluoranthene       | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 191-24-2  | Benzo(g,h,i)perylene       | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 207-08-9  | Benzo(k)fluoranthene       | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 117-81-7  | Bis(2-ethylhexyl)phthalate | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 218-01-9  | Chrysene                   | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 53-70-3   | Dibenzo(a,h)anthracene     | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 206-44-0  | Fluoranthene               | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 86-73-7   | Fluorene                   | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 118-74-1  | Hexachlorobenzene          | ND     |      | ug/L  | 0.0205             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 87-68-3   | Hexachlorobutadiene        | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 67-72-1   | Hexachloroethane           | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 193-39-5  | Indeno(1,2,3-cd)pyrene     | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |
| 91-20-3   | Naphthalene                | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 16:36      | OW      |





## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter              | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                                 | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------|------------------------|--------|------|-------|-----------------|----------|------------------------------------------------------------------|--------------------|--------------------|---------|
| 98-95-3  | Nitrobenzene           | ND     |      | ug/L  | 0.256           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 16:36   | OW      |
| 62-75-9  | N-Nitrosodimethylamine | ND     |      | ug/L  | 0.513           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 16:36   | OW      |
| 87-86-5  | Pentachlorophenol      | ND     |      | ug/L  | 0.256           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 16:36   | OW      |
| 85-01-8  | Phenanthrene           | ND     |      | ug/L  | 0.0513          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 16:36   | OW      |
| 129-00-0 | Pyrene                 | ND     |      | ug/L  | 0.0513          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 16:36   | OW      |

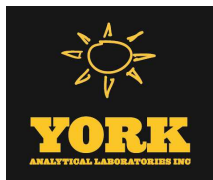
### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter          | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-54-8    | 4,4'-DDD           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 72-55-9    | 4,4'-DDE           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 50-29-3    | 4,4'-DDT           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 309-00-2   | Aldrin             | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 319-84-6   | alpha-BHC          | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 5103-71-9  | alpha-Chlordane    | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 319-85-7   | beta-BHC           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 319-86-8   | delta-BHC          | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 60-57-1    | Dieldrin           | ND     |      | ug/L  | 0.00200         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 959-98-8   | Endosulfan I       | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 33213-65-9 | Endosulfan II      | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 1031-07-8  | Endosulfan sulfate | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 72-20-8    | Endrin             | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 7421-93-4  | Endrin aldehyde    | ND     |      | ug/L  | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 53494-70-5                  | Endrin ketone                   | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 58-89-9                     | gamma-BHC (Lindane)             | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 5566-34-7                   | gamma-Chlordane                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 76-44-8                     | Heptachlor                      | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 1024-57-3                   | Heptachlor epoxide              | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 72-43-5                     | Methoxychlor                    | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 8001-35-2                   | Toxaphene                       | ND            |      | ug/L                    | 0.100           | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| 57-74-9                     | * Chlordane, total              | ND            |      | ug/L                    | 0.200           | 1        | EPA 8081B<br>Certifications:                                 | 01/02/2020 08:33   | 01/05/2020 08:48   | CM      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                 |          |                                                              |                    |                    |         |
| 2051-24-3                   | Surrogate: Decachlorobiphenyl   | 99.3 %        |      | 30-150                  |                 |          |                                                              |                    |                    |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 178 %         | S-GC | 30-150                  |                 |          |                                                              |                    |                    |         |

### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 12674-11-2                  | Aroclor 1016                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 11104-28-2                  | Aroclor 1221                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 11141-16-5                  | Aroclor 1232                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 53469-21-9                  | Aroclor 1242                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 12672-29-6                  | Aroclor 1248                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 11097-69-1                  | Aroclor 1254                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 11096-82-5                  | Aroclor 1260                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| 1336-36-3                   | * Total PCBs                    | ND            |      | ug/L                    | 0.0500          | 1        | EPA 8082A<br>Certifications:                                 | 01/02/2020 08:33   | 01/02/2020 19:59   | SR      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                 |          |                                                              |                    |                    |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 83.5 %        |      | 30-120                  |                 |          |                                                              |                    |                    |         |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

**York Project (SDG) No.**

19L1029

**Client Project ID**

9311-BKNY

**Matrix**

Water

**Collection Date/Time**

December 27, 2019 10:05 am

**Date Received**

12/30/2019

### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.   | Parameter                     | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-------------------------------|--------|------|-------|--------------------|----------|------------------|-----------------------|-----------------------|---------|
| 2051-24-3 | Surrogate: Decachlorobiphenyl | 97.0 % |      |       | 30-120             |          |                  |                       |                       |         |

### Metals, Target Analyte, ICP

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------|--------|------|-------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 7429-90-5 | Aluminum  | 0.458  |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-39-3 | Barium    | 0.0714 |      | mg/L  | 0.0278             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-70-2 | Calcium   | 78.7   |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7439-89-6 | Iron      | 0.715  |      | mg/L  | 0.278              | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7439-95-4 | Magnesium | 26.0   |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7439-96-5 | Manganese | 0.0310 |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-09-7 | Potassium | 2.92   |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-23-5 | Sodium    | 75.8   |      | mg/L  | 0.556              | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:28      | JAM     |

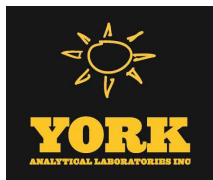
### Metals, Target Analyte, ICP Dissolved

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No. | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|---------|-----------|--------|------|-------|--------------------|----------|------------------|-----------------------|-----------------------|---------|
|---------|-----------|--------|------|-------|--------------------|----------|------------------|-----------------------|-----------------------|---------|



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 10:05 am

Date Received  
12/30/2019

### Metals, Target Analyte, ICP Dissolved

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-39-3 | Barium    | 0.0676 |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-70-2 | Calcium   | 78.4   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7439-89-6 | Iron      | ND     |      | mg/L  | 0.278           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7439-95-4 | Magnesium | 25.3   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7439-96-5 | Manganese | 0.0178 |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-09-7 | Potassium | 2.99   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-23-5 | Sodium    | 74.7   |      | mg/L  | 0.556           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:32   | JAM     |

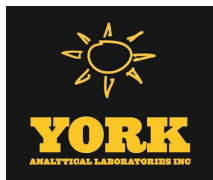
### Metals, Target Analyte, ICPMS

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:51   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:51   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:51   | BML     |



## Sample Information

**Client Sample ID:** MW-3

**York Sample ID:** 19L1029-03

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 10:05 am

**Date Received**  
12/30/2019

### Metals, Target Analyte, ICPMS

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:51   | BML     |
| 7782-49-2 | Selenium  | 6.03   |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:51   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:51   | BML     |

### Metals, Target Analyte, ICPMS Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:04   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:04   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:04   | BML     |
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:04   | BML     |
| 7782-49-2 | Selenium  | 4.69   |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:04   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:04   | BML     |

### Mercury by 7473

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.00020         | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/30/2019 16:35   | 12/30/2019 20:10   | MAO     |

### Mercury by 7473, Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.000200        | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 11:39   | 01/02/2020 15:39   | SY      |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:00 am

**Date Received**  
12/30/2019

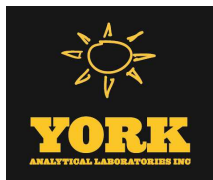
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.  | Parameter                                            | Result      | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------------------|-------------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 630-20-6 | 1,1,1,2-Tetrachloroethane                            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 71-55-6  | <b>1,1,1-Trichloroethane</b>                         | <b>0.42</b> | J    | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 79-34-5  | 1,1,2,2-Tetrachloroethane                            | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 76-13-1  | 1,1,2-Trichloro-1,2,2-trifluoroethane<br>(Freon 113) | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 79-00-5  | 1,1,2-Trichloroethane                                | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-34-3  | 1,1-Dichloroethane                                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-35-4  | <b>1,1-Dichloroethylene</b>                          | <b>0.40</b> | J    | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 87-61-6  | 1,2,3-Trichlorobenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 96-18-4  | 1,2,3-Trichloropropane                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 120-82-1 | 1,2,4-Trichlorobenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 95-63-6  | 1,2,4-Trimethylbenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 96-12-8  | 1,2-Dibromo-3-chloropropane                          | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 106-93-4 | 1,2-Dibromoethane                                    | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 95-50-1  | 1,2-Dichlorobenzene                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 107-06-2 | 1,2-Dichloroethane                                   | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 78-87-5  | 1,2-Dichloropropane                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 108-67-8 | 1,3,5-Trimethylbenzene                               | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 541-73-1 | 1,3-Dichlorobenzene                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 106-46-7 | 1,4-Dichlorobenzene                                  | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 123-91-1 | 1,4-Dioxane                                          | ND          |      | ug/L  | 40                     | 80   | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 78-93-3  | 2-Butanone                                           | ND          |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

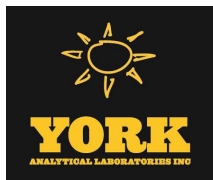
### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.    | Parameter                       | Result     | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|---------------------------------|------------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 591-78-6   | 2-Hexanone                      | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 108-10-1   | 4-Methyl-2-pentanone            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 67-64-1    | Acetone                         | ND         |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 107-02-8   | Acrolein                        | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 107-13-1   | Acrylonitrile                   | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 71-43-2    | Benzene                         | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 74-97-5    | Bromochloromethane              | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-27-4    | Bromodichloromethane            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-25-2    | Bromoform                       | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 74-83-9    | Bromomethane                    | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-15-0    | Carbon disulfide                | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 56-23-5    | Carbon tetrachloride            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 108-90-7   | Chlorobenzene                   | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-00-3    | Chloroethane                    | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 67-66-3    | <b>Chloroform</b>               | <b>1.4</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 74-87-3    | Chloromethane                   | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 156-59-2   | <b>cis-1,2-Dichloroethylene</b> | <b>1.1</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 10061-01-5 | cis-1,3-Dichloropropylene       | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 110-82-7   | Cyclohexane                     | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 124-48-1   | Dibromochloromethane            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 74-95-3    | Dibromomethane                  | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-71-8    | Dichlorodifluoromethane         | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |





## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

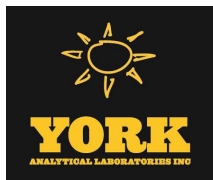
### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.     | Parameter                      | Result     | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-------------|--------------------------------|------------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 100-41-4    | Ethyl Benzene                  | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 87-68-3     | Hexachlorobutadiene            | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 98-82-8     | Isopropylbenzene               | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 79-20-9     | Methyl acetate                 | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 1634-04-4   | Methyl tert-butyl ether (MTBE) | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 108-87-2    | Methylcyclohexane              | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-09-2     | Methylene chloride             | ND         |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 104-51-8    | n-Butylbenzene                 | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 103-65-1    | n-Propylbenzene                | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 95-47-6     | o-Xylene                       | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 179601-23-1 | p- & m- Xylenes                | ND         |      | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 99-87-6     | p-Isopropyltoluene             | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 135-98-8    | sec-Butylbenzene               | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 100-42-5    | Styrene                        | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-65-0     | tert-Butyl alcohol (TBA)       | ND         |      | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 98-06-6     | tert-Butylbenzene              | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 127-18-4    | <b>Tetrachloroethylene</b>     | <b>9.1</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 108-88-3    | Toluene                        | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 156-60-5    | trans-1,2-Dichloroethylene     | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 10061-02-6  | trans-1,3-Dichloropropylene    | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 79-01-6     | <b>Trichloroethylene</b>       | <b>2.7</b> |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 75-69-4     | Trichlorofluoromethane         | ND         |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |





## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.                     | Parameter                                 | Result        | Flag | Units | Reported to<br>LOD/MDL  | LOQ  | Dilution | Reference Method                                                  | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|-------------------------------------------|---------------|------|-------|-------------------------|------|----------|-------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-01-4                     | Vinyl Chloride                            | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| 1330-20-7                   | Xylenes, Total                            | ND            |      | ug/L  | 0.60                    | 1.5  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,NJ | 01/02/2020 07:30      | 01/02/2020 15:09      | AB      |
| <b>Surrogate Recoveries</b> |                                           | <b>Result</b> |      |       | <b>Acceptance Range</b> |      |          |                                                                   |                       |                       |         |
| 17060-07-0                  | Surrogate: SURR:<br>1,2-Dichloroethane-d4 | 93.3 %        |      |       | 69-130                  |      |          |                                                                   |                       |                       |         |
| 2037-26-5                   | Surrogate: SURR: Toluene-d8               | 95.2 %        |      |       | 81-117                  |      |          |                                                                   |                       |                       |         |
| 460-00-4                    | Surrogate: SURR:<br>p-Bromofluorobenzene  | 99.5 %        |      |       | 79-122                  |      |          |                                                                   |                       |                       |         |

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-52-4  | 1,1-Biphenyl                             | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 95-94-3  | 1,2,4,5-Tetrachlorobenzene               | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 120-82-1 | 1,2,4-Trichlorobenzene                   | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 95-50-1  | 1,2-Dichlorobenzene                      | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 122-66-7 | 1,2-Diphenylhydrazine (as<br>Azobenzene) | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 541-73-1 | 1,3-Dichlorobenzene                      | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 106-46-7 | 1,4-Dichlorobenzene                      | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 58-90-2  | 2,3,4,6-Tetrachlorophenol                | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 95-95-4  | 2,4,5-Trichlorophenol                    | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 88-06-2  | 2,4,6-Trichlorophenol                    | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 120-83-2 | 2,4-Dichlorophenol                       | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 105-67-9 | 2,4-Dimethylphenol                       | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 51-28-5  | 2,4-Dinitrophenol                        | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 121-14-2 | 2,4-Dinitrotoluene                       | ND     |      | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

**SVOA, 8270 Low NJDEP/TCL/Part 375**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 3510C

| CAS No.    | Parameter                   | Result | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|-----------------------------|--------|-------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 606-20-2   | 2,6-Dinitrotoluene          | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 91-58-7    | 2-Chloronaphthalene         | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 95-57-8    | 2-Chlorophenol              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 91-57-6    | 2-Methylnaphthalene         | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 95-48-7    | 2-Methylphenol              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 88-74-4    | 2-Nitroaniline              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 88-75-5    | 2-Nitrophenol               | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 65794-96-9 | 3- & 4-Methylphenols        | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 91-94-1    | 3,3-Dichlorobenzidine       | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 99-09-2    | 3-Nitroaniline              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 534-52-1   | 4,6-Dinitro-2-methylphenol  | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 101-55-3   | 4-Bromophenyl phenyl ether  | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 59-50-7    | 4-Chloro-3-methylphenol     | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 106-47-8   | 4-Chloroaniline             | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 7005-72-3  | 4-Chlorophenyl phenyl ether | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 100-01-6   | 4-Nitroaniline              | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 100-02-7   | 4-Nitrophenol               | ND     |       | ug/L  | 5.13                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 98-86-2    | Acetophenone                | ND     |       | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 62-53-3    | Aniline                     | ND     | CCV-L | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 100-52-7   | Benzaldehyde                | ND     | CCV-L | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 92-87-5    | Benzidine                   | ND     | CCV-L | ug/L  | 5.13                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

**SVOA, 8270 Low NJDEP/TCL/Part 375**

**Log-in Notes:**

**Sample Notes:**

Sample Prepared by Method: EPA 3510C

| CAS No.                     | Parameter                             | Result        | Flag                    | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|---------------------------------------|---------------|-------------------------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 65-85-0                     | Benzoic acid                          | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 100-51-6                    | Benzyl alcohol                        | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 85-68-7                     | Benzyl butyl phthalate                | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 111-91-1                    | Bis(2-chloroethoxy)methane            | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 111-44-4                    | Bis(2-chloroethyl)ether               | ND            |                         | ug/L  | 1.03                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 108-60-1                    | Bis(2-chloroisopropyl)ether           | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 105-60-2                    | Caprolactam                           | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 86-74-8                     | Carbazole                             | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 132-64-9                    | Dibenzofuran                          | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 84-66-2                     | Diethyl phthalate                     | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 131-11-3                    | Dimethyl phthalate                    | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 84-74-2                     | Di-n-butyl phthalate                  | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 117-84-0                    | Di-n-octyl phthalate                  | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 77-47-4                     | Hexachlorocyclopentadiene             | ND            |                         | ug/L  | 5.13                   | 10.3 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 78-59-1                     | Isophorone                            | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 621-64-7                    | N-nitroso-di-n-propylamine            | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 86-30-6                     | N-Nitrosodiphenylamine                | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| 108-95-2                    | Phenol                                | ND            |                         | ug/L  | 2.56                   | 5.13 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 19:37      | OW      |
| <b>Surrogate Recoveries</b> |                                       | <b>Result</b> | <b>Acceptance Range</b> |       |                        |      |          |                                                              |                       |                       |         |
| 367-12-4                    | Surrogate: SURR: 2-Fluorophenol       | 45.6 %        | 19.7-63.1               |       |                        |      |          |                                                              |                       |                       |         |
| 4165-62-2                   | Surrogate: SURR: Phenol-d5            | 28.9 %        | 10.1-41.7               |       |                        |      |          |                                                              |                       |                       |         |
| 4165-60-0                   | Surrogate: SURR: Nitrobenzene-d5      | 78.0 %        | 50.2-113                |       |                        |      |          |                                                              |                       |                       |         |
| 321-60-8                    | Surrogate: SURR: 2-Fluorobiphenyl     | 79.9 %        | 39.9-105                |       |                        |      |          |                                                              |                       |                       |         |
| 118-79-6                    | Surrogate: SURR: 2,4,6-Tribromophenol | 99.7 %        | 39.3-151                |       |                        |      |          |                                                              |                       |                       |         |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKYN

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                      | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|--------------------------------|--------|------|-------|------------------------|-----|----------|------------------|-----------------------|-----------------------|---------|
| 1718-51-0 | Surrogate: SURR: Terphenyl-d14 | 78.0 % |      |       | 30.7-106               |     |          |                  |                       |                       |         |

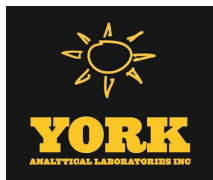
### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                  | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                                 | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|----------------------------|--------|------|-------|--------------------|----------|------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 83-32-9   | Acenaphthene               | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 208-96-8  | Acenaphthylene             | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 120-12-7  | Anthracene                 | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 1912-24-9 | Atrazine                   | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 56-55-3   | Benzo(a)anthracene         | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 50-32-8   | Benzo(a)pyrene             | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 205-99-2  | Benzo(b)fluoranthene       | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 191-24-2  | Benzo(g,h,i)perylene       | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 207-08-9  | Benzo(k)fluoranthene       | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 117-81-7  | Bis(2-ethylhexyl)phthalate | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 218-01-9  | Chrysene                   | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 53-70-3   | Dibenzo(a,h)anthracene     | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 206-44-0  | Fluoranthene               | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 86-73-7   | Fluorene                   | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 118-74-1  | Hexachlorobenzene          | ND     |      | ug/L  | 0.0205             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 87-68-3   | Hexachlorobutadiene        | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 67-72-1   | Hexachloroethane           | ND     |      | ug/L  | 0.513              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 193-39-5  | Indeno(1,2,3-cd)pyrene     | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |
| 91-20-3   | Naphthalene                | ND     |      | ug/L  | 0.0513             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:07      | OW      |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter              | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                                 | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------|------------------------|--------|------|-------|-----------------|----------|------------------------------------------------------------------|--------------------|--------------------|---------|
| 98-95-3  | Nitrobenzene           | ND     |      | ug/L  | 0.256           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 17:07   | OW      |
| 62-75-9  | N-Nitrosodimethylamine | ND     |      | ug/L  | 0.513           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 17:07   | OW      |
| 87-86-5  | Pentachlorophenol      | ND     |      | ug/L  | 0.256           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 17:07   | OW      |
| 85-01-8  | Phenanthrene           | ND     |      | ug/L  | 0.0513          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 17:07   | OW      |
| 129-00-0 | Pyrene                 | ND     |      | ug/L  | 0.0513          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 17:07   | OW      |

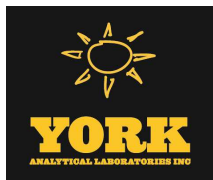
### Pesticides, NJDEP/TCL/Part 375 List

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter          | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-54-8    | 4,4'-DDD           | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 72-55-9    | 4,4'-DDE           | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 50-29-3    | 4,4'-DDT           | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 309-00-2   | Aldrin             | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 319-84-6   | alpha-BHC          | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 5103-71-9  | alpha-Chlordane    | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 319-85-7   | beta-BHC           | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 319-86-8   | delta-BHC          | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 60-57-1    | Dieldrin           | ND     |      | ug/L  | 0.00205         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 959-98-8   | Endosulfan I       | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 33213-65-9 | Endosulfan II      | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 1031-07-8  | Endosulfan sulfate | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 72-20-8    | Endrin             | ND     |      | ug/L  | 0.00410         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |
| 7421-93-4  | Endrin aldehyde    | ND     |      | ug/L  | 0.0103          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:06   | CM      |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:00 am

**Date Received**  
12/30/2019

### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 53494-70-5                  | Endrin ketone                   | ND            |      | ug/L                    | 0.0103             | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 58-89-9                     | gamma-BHC (Lindane)             | ND            |      | ug/L                    | 0.00410            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 5566-34-7                   | gamma-Chlordane                 | ND            |      | ug/L                    | 0.0103             | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 76-44-8                     | Heptachlor                      | ND            |      | ug/L                    | 0.00410            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 1024-57-3                   | Heptachlor epoxide              | ND            |      | ug/L                    | 0.00410            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 72-43-5                     | Methoxychlor                    | ND            |      | ug/L                    | 0.00410            | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 8001-35-2                   | Toxaphene                       | ND            |      | ug/L                    | 0.103              | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| 57-74-9                     | * Chlordane, total              | ND            |      | ug/L                    | 0.205              | 1        | EPA 8081B<br>Certifications:                                 | 01/02/2020 08:33      | 01/05/2020 09:06      | CM      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                    |          |                                                              |                       |                       |         |
| 2051-24-3                   | Surrogate: Decachlorobiphenyl   | 112 %         |      |                         |                    |          |                                                              |                       |                       |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 190 %         | S-GC |                         |                    |          |                                                              |                       |                       |         |

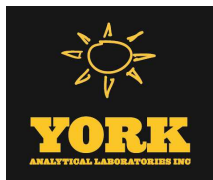
### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 12674-11-2                  | Aroclor 1016                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 11104-28-2                  | Aroclor 1221                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 11141-16-5                  | Aroclor 1232                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 53469-21-9                  | Aroclor 1242                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 12672-29-6                  | Aroclor 1248                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 11097-69-1                  | Aroclor 1254                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 11096-82-5                  | Aroclor 1260                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| 1336-36-3                   | * Total PCBs                    | ND            |      | ug/L                    | 0.0513             | 1        | EPA 8082A<br>Certifications:                                 | 01/02/2020 08:33      | 01/02/2020 20:26      | SR      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                    |          |                                                              |                       |                       |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 91.5 %        |      |                         |                    |          |                                                              |                       |                       |         |



## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:00 am

**Date Received**  
12/30/2019

### Polychlorinated Biphenyls (PCB)

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.   | Parameter                     | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-------------------------------|--------|------|-------|--------------------|----------|------------------|-----------------------|-----------------------|---------|
| 2051-24-3 | Surrogate: Decachlorobiphenyl | 111 %  |      |       | 30-120             |          |                  |                       |                       |         |

### Metals, Target Analyte, ICP

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------|--------|------|-------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 7429-90-5 | Aluminum  | 0.182  |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-39-3 | Barium    | 0.0700 |      | mg/L  | 0.0278             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-70-2 | Calcium   | 80.1   |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7439-89-6 | Iron      | 0.436  |      | mg/L  | 0.278              | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7439-95-4 | Magnesium | 26.0   |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7439-96-5 | Manganese | 0.0203 |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-09-7 | Potassium | 2.92   |      | mg/L  | 0.0556             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556            | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-23-5 | Sodium    | 74.3   |      | mg/L  | 0.556              | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278             | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:46      | 01/02/2020 14:31      | JAM     |

### Metals, Target Analyte, ICP Dissolved

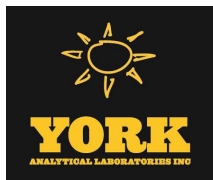
#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No. | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|---------|-----------|--------|------|-------|--------------------|----------|------------------|-----------------------|-----------------------|---------|
|---------|-----------|--------|------|-------|--------------------|----------|------------------|-----------------------|-----------------------|---------|





## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:00 am

**Date Received**  
12/30/2019

### Metals, Target Analyte, ICP Dissolved

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-39-3 | Barium    | 0.0671 |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-70-2 | Calcium   | 79.2   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7439-89-6 | Iron      | ND     |      | mg/L  | 0.278           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7439-95-4 | Magnesium | 25.2   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7439-96-5 | Manganese | 0.0101 |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-09-7 | Potassium | 3.02   |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-23-5 | Sodium    | 75.2   |      | mg/L  | 0.556           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:35   | JAM     |

### Metals, Target Analyte, ICPMS

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:57   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:57   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:57   | BML     |





## Sample Information

**Client Sample ID:** Duplicate

**York Sample ID:** 19L1029-04

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:00 am

**Date Received**  
12/30/2019

### Metals, Target Analyte, ICPMS

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:57   | BML     |
| 7782-49-2 | Selenium  | 6.46   |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:57   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 13:57   | BML     |

### Metals, Target Analyte, ICPMS Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:09   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:09   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:09   | BML     |
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:09   | BML     |
| 7782-49-2 | Selenium  | 6.33   |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:09   | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51   | 01/06/2020 16:09   | BML     |

### Mercury by 7473

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.00020         | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 16:22   | 01/02/2020 17:56   | SY      |

### Mercury by 7473, Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                            | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|-------------------------------------------------------------|--------------------|--------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.000200        | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 11:39   | 01/02/2020 15:47   | SY      |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

**York Project (SDG) No.**

19L1029

**Client Project ID**

9311-BKNY

**Matrix**

Water

**Collection Date/Time**

December 27, 2019 2:40 pm

**Date Received**

12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.  | Parameter                                            | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 630-20-6 | 1,1,1,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 71-55-6  | 1,1,1-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 79-34-5  | 1,1,2,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 76-13-1  | 1,1,2-Trichloro-1,2,2-trifluoroethane<br>(Freon 113) | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 79-00-5  | 1,1,2-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-34-3  | 1,1-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-35-4  | 1,1-Dichloroethylene                                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 87-61-6  | 1,2,3-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 96-18-4  | 1,2,3-Trichloropropane                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 120-82-1 | 1,2,4-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 95-63-6  | 1,2,4-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 96-12-8  | 1,2-Dibromo-3-chloropropane                          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 106-93-4 | 1,2-Dibromoethane                                    | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 95-50-1  | 1,2-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 107-06-2 | 1,2-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 78-87-5  | 1,2-Dichloropropane                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 108-67-8 | 1,3,5-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 541-73-1 | 1,3-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 106-46-7 | 1,4-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 123-91-1 | 1,4-Dioxane                                          | ND     |      | ug/L  | 40                     | 80   | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 78-93-3  | 2-Butanone                                           | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 2:40 pm

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.    | Parameter                 | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|---------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 591-78-6   | 2-Hexanone                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 108-10-1   | 4-Methyl-2-pentanone      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 67-64-1    | Acetone                   | ND     |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 107-02-8   | Acrolein                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 107-13-1   | Acrylonitrile             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 71-43-2    | Benzene                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 74-97-5    | Bromochloromethane        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-27-4    | Bromodichloromethane      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-25-2    | Bromoform                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 74-83-9    | Bromomethane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-15-0    | Carbon disulfide          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 56-23-5    | Carbon tetrachloride      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 108-90-7   | Chlorobenzene             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-00-3    | Chloroethane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 67-66-3    | Chloroform                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 74-87-3    | Chloromethane             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 156-59-2   | cis-1,2-Dichloroethylene  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 10061-01-5 | cis-1,3-Dichloropropylene | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 110-82-7   | Cyclohexane               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 124-48-1   | Dibromochloromethane      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 74-95-3    | Dibromomethane            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 2:40 pm

Date Received  
12/30/2019

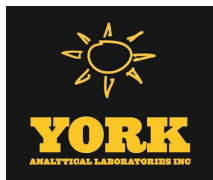
### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.     | Parameter                      | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-------------|--------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-71-8     | Dichlorodifluoromethane        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 100-41-4    | Ethyl Benzene                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 87-68-3     | Hexachlorobutadiene            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 98-82-8     | Isopropylbenzene               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 79-20-9     | Methyl acetate                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 1634-04-4   | Methyl tert-butyl ether (MTBE) | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 108-87-2    | Methylcyclohexane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-09-2     | Methylene chloride             | ND     |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 104-51-8    | n-Butylbenzene                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 103-65-1    | n-Propylbenzene                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 95-47-6     | o-Xylene                       | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 179601-23-1 | p- & m- Xylenes                | ND     |      | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 99-87-6     | p-Isopropyltoluene             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 135-98-8    | sec-Butylbenzene               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 100-42-5    | Styrene                        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-65-0     | tert-Butyl alcohol (TBA)       | ND     |      | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 98-06-6     | tert-Butylbenzene              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 127-18-4    | Tetrachloroethylene            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 108-88-3    | Toluene                        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 156-60-5    | trans-1,2-Dichloroethylene     | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 10061-02-6  | trans-1,3-Dichloropropylene    | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 2:40 pm

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.                     | Parameter                                  | Result        | Flag | Units | Reported to<br>LOD/MDL  | LOQ  | Dilution | Reference Method                                                  | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|--------------------------------------------|---------------|------|-------|-------------------------|------|----------|-------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 79-01-6                     | Trichloroethylene                          | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-69-4                     | Trichlorofluoromethane                     | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 75-01-4                     | Vinyl Chloride                             | ND            |      | ug/L  | 0.20                    | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| 1330-20-7                   | Xylenes, Total                             | ND            |      | ug/L  | 0.60                    | 1.5  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,NJ | 01/02/2020 06:28      | 01/02/2020 15:11      | LLJ     |
| <b>Surrogate Recoveries</b> |                                            | <b>Result</b> |      |       | <b>Acceptance Range</b> |      |          |                                                                   |                       |                       |         |
| 17060-07-0                  | Surrogate: SURRE:<br>1,2-Dichloroethane-d4 | 103 %         |      |       | 69-130                  |      |          |                                                                   |                       |                       |         |
| 2037-26-5                   | Surrogate: SURRE: Toluene-d8               | 99.1 %        |      |       | 81-117                  |      |          |                                                                   |                       |                       |         |
| 460-00-4                    | Surrogate: SURRE:<br>p-Bromofluorobenzene  | 94.0 %        |      |       | 79-122                  |      |          |                                                                   |                       |                       |         |

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 92-52-4  | 1,1-Biphenyl                             | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 95-94-3  | 1,2,4,5-Tetrachlorobenzene               | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 120-82-1 | 1,2,4-Trichlorobenzene                   | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 95-50-1  | 1,2-Dichlorobenzene                      | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 122-66-7 | 1,2-Diphenylhydrazine (as<br>Azobenzene) | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 541-73-1 | 1,3-Dichlorobenzene                      | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 106-46-7 | 1,4-Dichlorobenzene                      | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,PADEP             | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 58-90-2  | 2,3,4,6-Tetrachlorophenol                | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 95-95-4  | 2,4,5-Trichlorophenol                    | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 88-06-2  | 2,4,6-Trichlorophenol                    | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 120-83-2 | 2,4-Dichlorophenol                       | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 105-67-9 | 2,4-Dimethylphenol                       | ND     |      | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 2:40 pm

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.    | Parameter                   | Result | Flag  | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|-----------------------------|--------|-------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 51-28-5    | 2,4-Dinitrophenol           | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 121-14-2   | 2,4-Dinitrotoluene          | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 606-20-2   | 2,6-Dinitrotoluene          | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 91-58-7    | 2-Chloronaphthalene         | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 95-57-8    | 2-Chlorophenol              | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 91-57-6    | 2-Methylnaphthalene         | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 95-48-7    | 2-Methylphenol              | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 88-74-4    | 2-Nitroaniline              | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 88-75-5    | 2-Nitrophenol               | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 65794-96-9 | 3- & 4-Methylphenols        | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 91-94-1    | 3,3-Dichlorobenzidine       | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 99-09-2    | 3-Nitroaniline              | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 534-52-1   | 4,6-Dinitro-2-methylphenol  | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 101-55-3   | 4-Bromophenyl phenyl ether  | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 59-50-7    | 4-Chloro-3-methylphenol     | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 106-47-8   | 4-Chloroaniline             | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 7005-72-3  | 4-Chlorophenyl phenyl ether | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 100-01-6   | 4-Nitroaniline              | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 100-02-7   | 4-Nitrophenol               | ND     |       | ug/L  | 5.26                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 98-86-2    | Acetophenone                | ND     |       | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 62-53-3    | Aniline                     | ND     | CCV-L | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 2:40 pm

**Date Received**  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

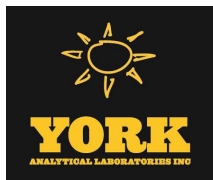
### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.                     | Parameter                       | Result        | Flag                    | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|-------------------------|-------|------------------------|------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 100-52-7                    | Benzaldehyde                    | ND            | CCV-L                   | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 92-87-5                     | Benzidine                       | ND            | CCV-L                   | ug/L  | 5.26                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 65-85-0                     | Benzoic acid                    | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 100-51-6                    | Benzyl alcohol                  | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 85-68-7                     | Benzyl butyl phthalate          | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 111-91-1                    | Bis(2-chloroethoxy)methane      | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 111-44-4                    | Bis(2-chloroethyl)ether         | ND            |                         | ug/L  | 1.05                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 108-60-1                    | Bis(2-chloroisopropyl)ether     | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 105-60-2                    | Caprolactam                     | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: NELAC-NY10854,NJDEP,PADEP       | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 86-74-8                     | Carbazole                       | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 132-64-9                    | Dibenzofuran                    | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 84-66-2                     | Diethyl phthalate               | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 131-11-3                    | Dimethyl phthalate              | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 84-74-2                     | Di-n-butyl phthalate            | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 117-84-0                    | Di-n-octyl phthalate            | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 77-47-4                     | Hexachlorocyclopentadiene       | ND            |                         | ug/L  | 5.26                   | 10.5 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 78-59-1                     | Isophorone                      | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 621-64-7                    | N-nitroso-di-n-propylamine      | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 86-30-6                     | N-Nitrosodiphenylamine          | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| 108-95-2                    | Phenol                          | ND            |                         | ug/L  | 2.63                   | 5.26 | 1        | EPA 8270D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 20:08      | OW      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> | <b>Acceptance Range</b> |       |                        |      |          |                                                              |                       |                       |         |
| 367-12-4                    | Surrogate: SURR: 2-Fluorophenol | 35.8 %        | 19.7-63.1               |       |                        |      |          |                                                              |                       |                       |         |
| 4165-62-2                   | Surrogate: SURR: Phenol-d5      | 24.4 %        | 10.1-41.7               |       |                        |      |          |                                                              |                       |                       |         |





## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 2:40 pm

**Date Received**  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                                | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ | Dilution | Reference Method | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|------------------------------------------|--------|------|-------|------------------------|-----|----------|------------------|-----------------------|-----------------------|---------|
| 4165-60-0 | Surrogate: SURR: Nitrobenzene-d5         | 54.0 % |      |       | 50.2-113               |     |          |                  |                       |                       |         |
| 321-60-8  | Surrogate: SURR: 2-Fluorobiphenyl        | 54.9 % |      |       | 39.9-105               |     |          |                  |                       |                       |         |
| 118-79-6  | Surrogate: SURR:<br>2,4,6-Tribromophenol | 60.6 % |      |       | 39.3-151               |     |          |                  |                       |                       |         |
| 1718-51-0 | Surrogate: SURR: Terphenyl-d14           | 56.0 % |      |       | 30.7-106               |     |          |                  |                       |                       |         |

### SVOA, 8270 Low NJDEP/TCL/Part 375

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.   | Parameter                  | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                                 | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|----------------------------|--------|------|-------|--------------------|----------|------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 83-32-9   | Acenaphthene               | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 208-96-8  | Acenaphthylene             | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 120-12-7  | Anthracene                 | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 1912-24-9 | Atrazine                   | ND     |      | ug/L  | 0.526              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 56-55-3   | Benzo(a)anthracene         | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 50-32-8   | Benzo(a)pyrene             | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 205-99-2  | Benzo(b)fluoranthene       | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 191-24-2  | Benzo(g,h,i)perylene       | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 207-08-9  | Benzo(k)fluoranthene       | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 117-81-7  | Bis(2-ethylhexyl)phthalate | ND     |      | ug/L  | 0.526              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 218-01-9  | Chrysene                   | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 53-70-3   | Dibenzo(a,h)anthracene     | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 206-44-0  | Fluoranthene               | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 86-73-7   | Fluorene                   | ND     |      | ug/L  | 0.0526             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 118-74-1  | Hexachlorobenzene          | ND     |      | ug/L  | 0.0211             | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 87-68-3   | Hexachlorobutadiene        | ND     |      | ug/L  | 0.526              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |
| 67-72-1   | Hexachloroethane           | ND     |      | ug/L  | 0.526              | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13      | 01/03/2020 17:39      | OW      |





## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 2:40 pm

Date Received  
12/30/2019

### SVOA, 8270 Low NJDEP/TCL/Part 375

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3510C

| CAS No.  | Parameter              | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                                 | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------|------------------------|--------|------|-------|-----------------|----------|------------------------------------------------------------------|--------------------|--------------------|---------|
| 193-39-5 | Indeno(1,2,3-cd)pyrene | ND     |      | ug/L  | 0.0526          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |
| 91-20-3  | Naphthalene            | ND     |      | ug/L  | 0.0526          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |
| 98-95-3  | Nitrobenzene           | ND     |      | ug/L  | 0.263           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |
| 62-75-9  | N-Nitrosodimethylamine | ND     |      | ug/L  | 0.526           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |
| 87-86-5  | Pentachlorophenol      | ND     |      | ug/L  | 0.263           | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP       | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |
| 85-01-8  | Phenanthrene           | ND     |      | ug/L  | 0.0526          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |
| 129-00-0 | Pyrene                 | ND     |      | ug/L  | 0.0526          | 1        | EPA 8270D SIM<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/03/2020 08:13   | 01/03/2020 17:39   | OW      |

### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter          | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-54-8    | 4,4'-DDD           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 72-55-9    | 4,4'-DDE           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 50-29-3    | 4,4'-DDT           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 309-00-2   | Aldrin             | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 319-84-6   | alpha-BHC          | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 5103-71-9  | alpha-Chlordane    | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 319-85-7   | beta-BHC           | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 319-86-8   | delta-BHC          | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 60-57-1    | Dieldrin           | ND     |      | ug/L  | 0.00200         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 959-98-8   | Endosulfan I       | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 33213-65-9 | Endosulfan II      | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 1031-07-8  | Endosulfan sulfate | ND     |      | ug/L  | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 2:40 pm

**Date Received**  
12/30/2019

### Pesticides, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.                     | Parameter                       | Result        | Flag | Units                   | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------------------------|---------------------------------|---------------|------|-------------------------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 72-20-8                     | Endrin                          | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 7421-93-4                   | Endrin aldehyde                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 53494-70-5                  | Endrin ketone                   | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 58-89-9                     | gamma-BHC (Lindane)             | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 5566-34-7                   | gamma-Chlordane                 | ND            |      | ug/L                    | 0.0100          | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 76-44-8                     | Heptachlor                      | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 1024-57-3                   | Heptachlor epoxide              | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 72-43-5                     | Methoxychlor                    | ND            |      | ug/L                    | 0.00400         | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 8001-35-2                   | Toxaphene                       | ND            |      | ug/L                    | 0.100           | 1        | EPA 8081B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| 57-74-9                     | * Chlordane, total              | ND            |      | ug/L                    | 0.200           | 1        | EPA 8081B<br>Certifications:                                 | 01/02/2020 08:33   | 01/05/2020 09:24   | CM      |
| <b>Surrogate Recoveries</b> |                                 | <b>Result</b> |      | <b>Acceptance Range</b> |                 |          |                                                              |                    |                    |         |
| 2051-24-3                   | Surrogate: Decachlorobiphenyl   | 128 %         |      |                         |                 |          |                                                              |                    |                    |         |
| 877-09-8                    | Surrogate: Tetrachloro-m-xylene | 198 %         | S-GC |                         |                 |          |                                                              |                    |                    |         |

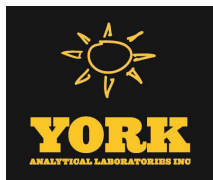
### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.    | Parameter    | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|------------|--------------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 12674-11-2 | Aroclor 1016 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| 11104-28-2 | Aroclor 1221 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| 11141-16-5 | Aroclor 1232 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| 53469-21-9 | Aroclor 1242 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| 12672-29-6 | Aroclor 1248 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| 11097-69-1 | Aroclor 1254 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| 11096-82-5 | Aroclor 1260 | ND     |      | ug/L  | 0.0500          | 1        | EPA 8082A<br>Certifications: NELAC-NY10854,CTDOH,NJDEP,PADEP | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 2:40 pm

**Date Received**  
12/30/2019

### Polychlorinated Biphenyls (PCB)

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA SW846-3510C Low Level

| CAS No.              | Parameter                       | Result | Flag | Units            | Reported to LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|----------------------|---------------------------------|--------|------|------------------|-----------------|----------|------------------|--------------------|--------------------|---------|
| 1336-36-3            | * Total PCBs                    | ND     |      | ug/L             | 0.0500          | 1        | EPA 8082A        | 01/02/2020 08:33   | 01/02/2020 20:40   | SR      |
| Surrogate Recoveries |                                 | Result |      | Acceptance Range |                 |          |                  |                    |                    |         |
| 877-09-8             | Surrogate: Tetrachloro-m-xylene | 91.5 % |      | 30-120           |                 |          |                  |                    |                    |         |
| 2051-24-3            | Surrogate: Decachlorobiphenyl   | 113 %  |      | 30-120           |                 |          |                  |                    |                    |         |

### Metals, Target Analyte, ICP

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result                                          | Flag | Units | Reported to LOQ | Dilution | Reference Method | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|-------------------------------------------------|------|-------|-----------------|----------|------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | ND                                              |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-39-3 | Barium    | ND                                              |      | mg/L  | 0.0278          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-70-2 | Calcium   | ND                                              |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-47-3 | Chromium  | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-48-4 | Cobalt    | ND                                              |      | mg/L  | 0.00444         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-50-8 | Copper    | ND                                              |      | mg/L  | 0.0222          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-89-6 | Iron      | ND                                              |      | mg/L  | 0.278           | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-92-1 | Lead      | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-95-4 | Magnesium | ND                                              |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7439-96-5 | Manganese | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-02-0 | Nickel    | ND                                              |      | mg/L  | 0.0111          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-09-7 | Potassium | ND                                              |      | mg/L  | 0.0556          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-22-4 | Silver    | ND                                              |      | mg/L  | 0.00556         | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-23-5 | Sodium    | ND                                              |      | mg/L  | 0.556           | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-62-2 | Vanadium  | ND                                              |      | mg/L  | 0.0111          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |
| 7440-66-6 | Zinc      | ND                                              |      | mg/L  | 0.0278          | 1        | EPA 6010D        | 12/31/2019 18:46   | 01/02/2020 14:34   | JAM     |
|           |           | Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP |      |       |                 |          |                  |                    |                    |         |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

York Project (SDG) No.

19L1029

Client Project ID

9311-BKNY

Matrix

Water

Collection Date/Time

December 27, 2019 2:40 pm

Date Received

12/30/2019

### Metals, Target Analyte, ICP Dissolved

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7429-90-5 | Aluminum  | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-39-3 | Barium    | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-70-2 | Calcium   | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-47-3 | Chromium  | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-48-4 | Cobalt    | ND     |      | mg/L  | 0.00444         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-50-8 | Copper    | ND     |      | mg/L  | 0.0222          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7439-89-6 | Iron      | ND     |      | mg/L  | 0.278           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7439-92-1 | Lead      | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7439-95-4 | Magnesium | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7439-96-5 | Manganese | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-02-0 | Nickel    | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-09-7 | Potassium | ND     |      | mg/L  | 0.0556          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-22-4 | Silver    | ND     |      | mg/L  | 0.00556         | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-23-5 | Sodium    | ND     |      | mg/L  | 0.556           | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-62-2 | Vanadium  | ND     |      | mg/L  | 0.0111          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |
| 7440-66-6 | Zinc      | ND     |      | mg/L  | 0.0278          | 1        | EPA 6010D<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:54   | 01/03/2020 13:38   | JAM     |

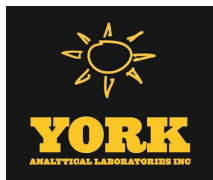
### Metals, Target Analyte, ICPMS

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to LOQ | Dilution | Reference Method                                             | Date/Time Prepared | Date/Time Analyzed | Analyst |
|-----------|-----------|--------|------|-------|-----------------|----------|--------------------------------------------------------------|--------------------|--------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 14:02   | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11            | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 14:02   | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333           | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48   | 01/06/2020 14:02   | BML     |



## Sample Information

**Client Sample ID:** Field Blank

**York Sample ID:** 19L1029-05

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 2:40 pm

**Date Received**  
12/30/2019

### Metals, Target Analyte, ICPMS

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------|--------|------|-------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556              | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48      | 01/06/2020 14:02      | BML     |
| 7782-49-2 | Selenium  | ND     |      | ug/L  | 1.11               | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48      | 01/06/2020 14:02      | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11               | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:48      | 01/06/2020 14:02      | BML     |

### Metals, Target Analyte, ICPMS Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 3015A

| CAS No.   | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                             | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------|--------|------|-------|--------------------|----------|--------------------------------------------------------------|-----------------------|-----------------------|---------|
| 7440-36-0 | Antimony  | ND     |      | ug/L  | 1.11               | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51      | 01/06/2020 16:29      | BML     |
| 7440-38-2 | Arsenic   | ND     |      | ug/L  | 1.11               | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51      | 01/06/2020 16:29      | BML     |
| 7440-41-7 | Beryllium | ND     |      | ug/L  | 0.333              | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51      | 01/06/2020 16:29      | BML     |
| 7440-43-9 | Cadmium   | ND     |      | ug/L  | 0.556              | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51      | 01/06/2020 16:29      | BML     |
| 7782-49-2 | Selenium  | ND     |      | ug/L  | 1.11               | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51      | 01/06/2020 16:29      | BML     |
| 7440-28-0 | Thallium  | ND     |      | ug/L  | 1.11               | 1        | EPA 6020B<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/31/2019 18:51      | 01/06/2020 16:29      | BML     |

### Mercury by 7473

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                            | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------|--------|------|-------|--------------------|----------|-------------------------------------------------------------|-----------------------|-----------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.00020            | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 12/30/2019 16:35      | 12/30/2019 20:20      | MAO     |

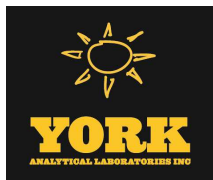
### Mercury by 7473, Dissolved

#### Log-in Notes:

#### Sample Notes:

Sample Prepared by Method: EPA 7473 water

| CAS No.   | Parameter | Result | Flag | Units | Reported to<br>LOQ | Dilution | Reference Method                                            | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-----------|-----------|--------|------|-------|--------------------|----------|-------------------------------------------------------------|-----------------------|-----------------------|---------|
| 7439-97-6 | Mercury   | ND     |      | mg/L  | 0.000200           | 1        | EPA 7473<br>Certifications: CTDOH,NELAC-NY10854,NJDEP,PADEP | 01/02/2020 11:39      | 01/02/2020 15:57      | SY      |



## Sample Information

**Client Sample ID:** Trip Blank

**York Sample ID:** 19L1029-06

**York Project (SDG) No.**

19L1029

**Client Project ID**

9311-BKNY

**Matrix**

Water

**Collection Date/Time**

December 27, 2019 12:00 am

**Date Received**

12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.  | Parameter                                            | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------|------------------------------------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 630-20-6 | 1,1,1,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 71-55-6  | 1,1,1-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 79-34-5  | 1,1,2,2-Tetrachloroethane                            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 76-13-1  | 1,1,2-Trichloro-1,2,2-trifluoroethane<br>(Freon 113) | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 79-00-5  | 1,1,2-Trichloroethane                                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-34-3  | 1,1-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-35-4  | 1,1-Dichloroethylene                                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 87-61-6  | 1,2,3-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 96-18-4  | 1,2,3-Trichloropropane                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 120-82-1 | 1,2,4-Trichlorobenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 95-63-6  | 1,2,4-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 96-12-8  | 1,2-Dibromo-3-chloropropane                          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 106-93-4 | 1,2-Dibromoethane                                    | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 95-50-1  | 1,2-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 107-06-2 | 1,2-Dichloroethane                                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 78-87-5  | 1,2-Dichloropropane                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 108-67-8 | 1,3,5-Trimethylbenzene                               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 541-73-1 | 1,3-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 106-46-7 | 1,4-Dichlorobenzene                                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 123-91-1 | 1,4-Dioxane                                          | ND     |      | ug/L  | 40                     | 80   | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 78-93-3  | 2-Butanone                                           | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |



## Sample Information

**Client Sample ID:** Trip Blank

**York Sample ID:** 19L1029-06

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.    | Parameter                 | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                   | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|------------|---------------------------|--------|------|-------|------------------------|------|----------|--------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 591-78-6   | 2-Hexanone                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 108-10-1   | 4-Methyl-2-pentanone      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 67-64-1    | Acetone                   | ND     |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 107-02-8   | Acrolein                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 107-13-1   | Acrylonitrile             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 71-43-2    | Benzene                   | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 74-97-5    | Bromochloromethane        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-27-4    | Bromodichloromethane      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-25-2    | Bromoform                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 74-83-9    | Bromomethane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-15-0    | Carbon disulfide          | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 56-23-5    | Carbon tetrachloride      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 108-90-7   | Chlorobenzene             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-00-3    | Chloroethane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 67-66-3    | Chloroform                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 74-87-3    | Chloromethane             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 156-59-2   | cis-1,2-Dichloroethylene  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 10061-01-5 | cis-1,3-Dichloropropylene | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 110-82-7   | Cyclohexane               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 124-48-1   | Dibromochloromethane      | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA  | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 74-95-3    | Dibromomethane            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |





## Sample Information

**Client Sample ID:** Trip Blank

**York Sample ID:** 19L1029-06

**York Project (SDG) No.**  
19L1029

**Client Project ID**  
9311-BKNY

**Matrix**  
Water

**Collection Date/Time**  
December 27, 2019 12:00 am

**Date Received**  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.     | Parameter                      | Result | Flag | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                    | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|-------------|--------------------------------|--------|------|-------|------------------------|------|----------|---------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 75-71-8     | Dichlorodifluoromethane        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 100-41-4    | Ethyl Benzene                  | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 87-68-3     | Hexachlorobutadiene            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 98-82-8     | Isopropylbenzene               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 79-20-9     | Methyl acetate                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 1634-04-4   | Methyl tert-butyl ether (MTBE) | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 108-87-2    | Methylcyclohexane              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-09-2     | Methylene chloride             | ND     |      | ug/L  | 1.0                    | 2.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 104-51-8    | n-Butylbenzene                 | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 103-65-1    | n-Propylbenzene                | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 95-47-6     | o-Xylene                       | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 179601-23-1 | p- & m- Xylenes                | ND     |      | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 99-87-6     | p-Isopropyltoluene             | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 135-98-8    | sec-Butylbenzene               | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 100-42-5    | Styrene                        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-65-0     | tert-Butyl alcohol (TBA)       | ND     |      | ug/L  | 0.50                   | 1.0  | 1        | EPA 8260C<br>Certifications: NELAC-NY10854,NELAC-NY12058,PADEP,NJIE | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 98-06-6     | tert-Butylbenzene              | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 127-18-4    | Tetrachloroethylene            | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 108-88-3    | Toluene                        | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 156-60-5    | trans-1,2-Dichloroethylene     | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 10061-02-6  | trans-1,3-Dichloropropylene    | ND     |      | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA   | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |





## Sample Information

**Client Sample ID:** Trip Blank

**York Sample ID:** 19L1029-06

York Project (SDG) No.  
19L1029

Client Project ID  
9311-BKNY

Matrix  
Water

Collection Date/Time  
December 27, 2019 12:00 am

Date Received  
12/30/2019

### Volatile Organics, NJDEP/TCL/Part 375 List

### Log-in Notes:

### Sample Notes:

Sample Prepared by Method: EPA 5030B

| CAS No.              | Parameter                                 | Result | Flag             | Units | Reported to<br>LOD/MDL | LOQ  | Dilution | Reference Method                                                  | Date/Time<br>Prepared | Date/Time<br>Analyzed | Analyst |
|----------------------|-------------------------------------------|--------|------------------|-------|------------------------|------|----------|-------------------------------------------------------------------|-----------------------|-----------------------|---------|
| 79-01-6              | Trichloroethylene                         | ND     |                  | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-69-4              | Trichlorofluoromethane                    | ND     |                  | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 75-01-4              | Vinyl Chloride                            | ND     |                  | ug/L  | 0.20                   | 0.50 | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,PA | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| 1330-20-7            | Xylenes, Total                            | ND     |                  | ug/L  | 0.60                   | 1.5  | 1        | EPA 8260C<br>Certifications: CTDOH,NELAC-NY10854,NELAC-NY12058,NJ | 01/02/2020 06:28      | 01/02/2020 14:45      | LLJ     |
| Surrogate Recoveries |                                           | Result | Acceptance Range |       |                        |      |          |                                                                   |                       |                       |         |
| 17060-07-0           | Surrogate: SURR:<br>1,2-Dichloroethane-d4 | 103 %  | 69-130           |       |                        |      |          |                                                                   |                       |                       |         |
| 2037-26-5            | Surrogate: SURR: Toluene-d8               | 97.8 % | 81-117           |       |                        |      |          |                                                                   |                       |                       |         |
| 460-00-4             | Surrogate: SURR:<br>p-Bromofluorobenzene  | 97.4 % | 79-122           |       |                        |      |          |                                                                   |                       |                       |         |



### Volatile Analysis Sample Containers

| Lab ID     | Client Sample ID | Volatile Sample Container                     |
|------------|------------------|-----------------------------------------------|
| 19L1029-01 | MW-1             | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 19L1029-02 | MW-2             | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 19L1029-03 | MW-3             | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 19L1029-04 | Duplicate        | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 19L1029-05 | Field Blank      | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |
| 19L1029-06 | Trip Blank       | 40mL Clear Vial (pre-pres.) HCl; Cool to 4° C |



### Sample and Data Qualifiers Relating to This Work Order

|        |                                                                                                                                                                                                                             |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| QC-LCS | LCS/LCS Dup recovery was above laboratory control limits. Sample does not contain any target compounds; therefore sample results are acceptable.                                                                            |
| CCV-E  | The value reported is ESTIMATED. The value is estimated due to its behavior during continuing calibration verification (>20% Difference for average Rf or >20% Drift for quadratic fit).                                    |
| CCV-H  | The value reported is estimated due to its behavior during continuing calibration verification (>20% difference for average RF or >20% drift for linear or quadratic fit.) This value may be biased high.                   |
| CCV-L  | The value reported is estimated due to its behavior during continuing calibration verification (>20% difference for average RF or >20% drift for linear or quadratic fit.) This value may be biased low.                    |
| J      | Detected below the Reporting Limit but greater than or equal to the Method Detection Limit (MDL/LOD) or in the case of a TIC, the result is an estimated concentration.                                                     |
| M-BS   | The recovery for this element in the batch blank spike recovered slightly outside of control limits                                                                                                                         |
| M-CRL  | The RL check for this element recovered outside of control limits.                                                                                                                                                          |
| M-ICV2 | The recovery for this element in the ICV was outside the 90-110% recovery criteria.                                                                                                                                         |
| B      | Analyte is found in the associated analysis batch blank. For volatiles, methylene chloride and acetone are common lab contaminants.                                                                                         |
| M-SRD1 | The serial dilution for this element was outside control limits.                                                                                                                                                            |
| S-HI   | Surrogate recovery is above acceptance limits. No target compound is detected in sample.                                                                                                                                    |
| QL-02  | This LCS analyte is outside Laboratory Recovery limits due the analyte behavior using the referenced method. The reference method has certain limitations with respect to analytes of this nature.                          |
| QM-05  | The spike recovery was outside acceptance limits for the MS and/or MSD due to matrix interference. The LCS and/or LCSD were within acceptance limits showing that the laboratory is in control and the data are acceptable. |
| QM-07  | The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.                                                                                            |
| QR-02  | The RPD result exceeded the QC control limits; however, both percent recoveries were acceptable. Sample results for the QC batch were accepted based on percent recoveries and completeness of QC data.                     |
| QR-03  | The RPD value for the sample duplicate or MS/MSD was outside of QC acceptance limits due to matrix interference. QC batch accepted based on LCS and/or LCSD recovery and/or RPD values.                                     |
| S-08   | The recovery of this surrogate was outside of QC limits.                                                                                                                                                                    |
| S-GC   | Two surrogates are used for this analysis. One surrogate recovered within control limits therefore the analysis is acceptable.                                                                                              |
| M-SPKM | The spike recovery is not within acceptance windows due to sample non-homogeneity, or matrix interference.                                                                                                                  |

### Definitions and Other Explanations

|     |                                                                                                                                                                                                                                                                                                                                                                          |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| *   | Analyte is not certified or the state of the samples origination does not offer certification for the Analyte.                                                                                                                                                                                                                                                           |
| ND  | NOT DETECTED - the analyte is not detected at the Reported to level (LOQ/RL or LOD/MDL)                                                                                                                                                                                                                                                                                  |
| RL  | REPORTING LIMIT - the minimum reportable value based upon the lowest point in the analyte calibration curve.                                                                                                                                                                                                                                                             |
| LOQ | LIMIT OF QUANTITATION - the minimum concentration of a target analyte that can be reported within a specified degree of confidence. This is the lowest point in an analyte calibration curve that has been subjected to all steps of the processing/analysis and verified to meet defined criteria. This is based upon NELAC 2009 Standards and applies to all analyses. |
| LOD | LIMIT OF DETECTION - a verified estimate of the minimum concentration of a substance in a given matrix that an analytical process can reliably detect. This is based upon NELAC 2009 Standards and applies to all analyses conducted under the auspices of EPA SW-846.                                                                                                   |
| MDL | METHOD DETECTION LIMIT - a statistically derived estimate of the minimum amount of a substance an analytical system can reliably detect with a 99% confidence that the concentration of the substance is greater than zero. This is based upon 40 CFR Part 136 Appendix B and applies only to EPA 600 and 200 series methods.                                            |



|             |                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reported to | This indicates that the data for a particular analysis is reported to either the LOD/MDL, or the LOQ/RL. In cases where the "Reported to" is located above the LOD/MDL, any value between this and the LOQ represents an estimated value which is "J" flagged accordingly. This applies to volatile and semi-volatile target compounds only.                                                                                                 |
| NR          | Not reported                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| RPD         | Relative Percent Difference                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Wet         | The data has been reported on an as-received (wet weight) basis                                                                                                                                                                                                                                                                                                                                                                              |
| Low Bias    | Low Bias flag indicates that the recovery of the flagged analyte is below the laboratory or regulatory lower control limit. The data user should take note that this analyte may be biased low but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.           |
| High Bias   | High Bias flag indicates that the recovery of the flagged analyte is above the laboratory or regulatory upper control limit. The data user should take note that this analyte may be biased high but should evaluate multiple lines of evidence including the LCS and site-specific MS/MSD data to draw bias conclusions. In cases where no site-specific MS/MSD was requested, only the LCS data can be used to evaluate such bias.         |
| Non-Dir.    | Non-dir. flag (Non-Directional Bias ) indicates that the Relative Percent Difference (RPD) (a measure of precision) among the MS and MSD data is outside the laboratory or regulatory control limit. This alerts the data user where the MS and MSD are from site-specific samples that the RPD is high due to either non-homogeneous distribution of target analyte between the MS/MSD or indicates poor reproducibility for other reasons. |

If EPA SW-846 method 8270 is included herein it is noted that the target compound N-nitrosodiphenylamine (NDPA) decomposes in the gas chromatographic inlet and cannot be separated from diphenylamine (DPA). These results could actually represent 100% DPA, 100% NDPA or some combination of the two. For this reason, York reports the combined result for n-nitrosodiphenylamine and diphenylamine for either of these compounds as a combined concentration as Diphenylamine.

If Total PCBs are detected and the target aroclors reported are "Not detected", the Total PCB value is reported due to the presence of either or both Aroclors 1262 and 1268 which are non-target aroclors for some regulatory lists.

2-chloroethylvinyl ether readily breaks down under acidic conditions. Samples that are acid preserved, including standards will exhibit breakdown. The data user should take note.

Certification for pH is no longer offered by NYDOH ELAP.

Semi-Volatile and Volatile analyses are reported down to the LOD/MDL, with values between the LOD/MDL and the LOQ being "J" flagged as estimated results.

For analyses by EPA SW-846-8270D, the Limit of Quantitation (LOQ) reported for benzidine is based upon the lowest standard used for calibration and is not a verified LOQ due to this compound's propensity for oxidative losses during extraction/concentration procedures and non-reproducible chromatographic performance.



**YORK**  
ANALYTICAL LABORATORIES, INC.

York Analytical Laboratories, Inc.  
120 Research Drive  
Stratford, CT 06615  
clientservices@yorklab.com  
www.yorklab.com

# Field Chain-of-Custody Record

YORK Project No.

19L 1029

Page 1 of 1

NOTE: YORK's Standard Terms & Conditions are listed on the back side of this document. This document serves as your written authorization for YORK to proceed with the analyses requested below. Your signature binds you to YORK's Standard Terms & Conditions.

| YOUR INFORMATION                                                                                                                                                                          |                    | Report To:          |                         | Invoice To:                       |                            | YOUR Project Number                   |                                                           | Turn-Around Time               |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------|-------------------------|-----------------------------------|----------------------------|---------------------------------------|-----------------------------------------------------------|--------------------------------|--|
| Company:                                                                                                                                                                                  | Advanced Chem Tech | Company:            | ACT                     | Company:                          | ACT                        | 9311-13Kwy                            |                                                           | RUSH - Next Day                |  |
| Address:                                                                                                                                                                                  | 110 Main St        | Address:            | same                    | Address:                          | same                       | YOUR Project Name                     |                                                           | RUSH - Two Day                 |  |
| Phone:                                                                                                                                                                                    | 516-441-5800       | Phone:              |                         | Phone:                            |                            |                                       |                                                           | RUSH - Three Day               |  |
| Contact:                                                                                                                                                                                  | Jason Stewart      | Contact:            | Paul Stewart            | Contact:                          | Kevin Enright              |                                       |                                                           | RUSH - Four Day                |  |
| E-mail:                                                                                                                                                                                   | jasens@act-act.com | E-mail:             | PaulStewart@act-act.com | E-mail:                           | Kevin.Enright@act-act.com  |                                       |                                                           | Standard (5-7 Day)             |  |
| Please print clearly and legibly. All information must be complete. Samples will not be logged in and the turn-around-time clock will not begin until any questions by YORK are resolved. |                    |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| Samples Collected by: (print your name above and sign below)                                                                                                                              |                    |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| Tim Yang                                                                                                                                                                                  |                    |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| 7-72                                                                                                                                                                                      |                    |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| Sample Identification                                                                                                                                                                     |                    | Matrix Codes        |                         | Samples From                      |                            | Report / EDD Type (circle selections) |                                                           | YORK Reg. Comp.                |  |
| MW-1                                                                                                                                                                                      | GW                 | S - soil / solid    | New York                | Summary Report                    | CT RCP                     | Standard Excel EDD                    | Compared to the following Regulation(s): (please fill in) |                                |  |
| MW-2                                                                                                                                                                                      | "                  | GW - groundwater    | New Jersey              | QA Report                         | CT RCP DQADUE              | EQUS (Standard)                       | NYSDEC                                                    |                                |  |
| MW-3                                                                                                                                                                                      | "                  | DW - drinking water | Connecticut             | NY ASP A Package                  | NUDEP Reduced Deliverables | NYSDEC EQUIS                          | TDOS (GA)                                                 |                                |  |
| Duplicate                                                                                                                                                                                 | "                  | WW - wastewater     | Pennsylvania            | NY ASP B Package                  | NUDEP SRP HazSite          | Other:                                |                                                           |                                |  |
| MW-1 MS/MSD                                                                                                                                                                               | "                  | O - Oil             | Other                   |                                   | NUDEP SRP HazSite          |                                       |                                                           |                                |  |
| Field Blank                                                                                                                                                                               | Di                 |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| TRIP BLANK                                                                                                                                                                                | Di                 |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| Sample Identification                                                                                                                                                                     |                    | Sample Matrix       |                         | Date/Time Sampled                 |                            | Analysis Requested                    |                                                           | Container Description          |  |
| MW-1                                                                                                                                                                                      | GW                 |                     |                         | 12/27/19                          | 1315                       |                                       | TCL VOC's, SWOC's, TAL                                    | 3 VOC's w/ HCL                 |  |
| MW-2                                                                                                                                                                                      | "                  |                     |                         | "                                 | 1315                       |                                       | metals, Pest + PCB's                                      | 4 amberes                      |  |
| MW-3                                                                                                                                                                                      | "                  |                     |                         | "                                 | 1005                       |                                       |                                                           | 500 cc ampers                  |  |
| Duplicate                                                                                                                                                                                 | "                  |                     |                         | "                                 |                            |                                       |                                                           | 250 ml HNO3                    |  |
| MW-1 MS/MSD                                                                                                                                                                               | "                  |                     |                         | "                                 | 1-100                      |                                       |                                                           | per                            |  |
| Field Blank                                                                                                                                                                               | Di                 |                     |                         | "                                 | 1440                       |                                       |                                                           |                                |  |
| TRIP BLANK                                                                                                                                                                                | Di                 |                     |                         | "                                 |                            |                                       | VOC's                                                     | 3 VOC's w/ HCL                 |  |
| <b>Comments:</b> LAB TO FILTER 500cc no pres - see labels - (TY)                                                                                                                          |                    |                     |                         |                                   |                            |                                       |                                                           |                                |  |
| Samples Relinquished by / Company                                                                                                                                                         |                    | Date/Time           |                         | Samples Relinquished by / Company |                            | Date/Time                             |                                                           | Special Instruction            |  |
| Jouah Stronsson                                                                                                                                                                           |                    | 12/30/19 12:10 PM   |                         | Jouah Stronsson                   |                            | 12-30-19 12:10 PM                     |                                                           | Field Filtered Lab to Filter X |  |
| Samples Received by / Company                                                                                                                                                             |                    | Date/Time           |                         | Samples Received by / Company     |                            | Date/Time                             |                                                           |                                |  |
| Labonville                                                                                                                                                                                |                    | 12/30/19 2:30 PM    |                         | Labonville                        |                            | 12-30-19 2:30 PM                      |                                                           |                                |  |
| Samples Relinquished by / Company                                                                                                                                                         |                    | Date/Time           |                         | Samples Received in LAB by        |                            | Date/Time                             |                                                           | Temp. Received at Lab          |  |
|                                                                                                                                                                                           |                    |                     |                         | 7 Dec 12-30-19 1637               |                            |                                       |                                                           | 1.9                            |  |

## **Appendix H**

### **Executed IC/EC Certification Form**



Enclosure 2  
**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**  
**Site Management Periodic Review Report Notice**  
**Institutional and Engineering Controls Certification Form**



|                                                                                                                                                             |                                     |                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|
| <b>Site No.</b> C224233                                                                                                                                     | <b>Site Details</b>                 | <b>Box 1</b>                        |
| <b>Site Name</b> Williamsburg Bridgeview Apartments                                                                                                         |                                     |                                     |
| Site Address: 105 S. 5th Street      Zip Code: 11249                                                                                                        |                                     |                                     |
| City/Town: Brooklyn                                                                                                                                         |                                     |                                     |
| County: Kings                                                                                                                                               |                                     |                                     |
| Site Acreage: 0.366                                                                                                                                         |                                     |                                     |
| Reporting Period: December 27, 2018 to April 27, 2020                                                                                                       |                                     |                                     |
|                                                                                                                                                             |                                     | YES    NO                           |
| 1. Is the information above correct?                                                                                                                        | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| If NO, include handwritten above or on a separate sheet.                                                                                                    |                                     |                                     |
| 2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period?                       | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 3. Has there been any change of use at the site during this Reporting Period (see 6NYCRR 375-1.11(d))?                                                      | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| 4. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period?               | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| If you answered YES to questions 2 thru 4, include documentation or evidence that documentation has been previously submitted with this certification form. |                                     |                                     |
| 5. Is the site currently undergoing development?                                                                                                            | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |

|                                                                                                                           |                                                              |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|
|                                                                                                                           | <b>Box 2</b>                                                 |
|                                                                                                                           | YES    NO                                                    |
| 6. Is the current site use consistent with the use(s) listed below?<br>Restricted-Residential, Commercial, and Industrial | <input checked="" type="checkbox"/> <input type="checkbox"/> |
| 7. Are all ICs/ECs in place and functioning as designed?                                                                  | <input checked="" type="checkbox"/> <input type="checkbox"/> |

**IF THE ANSWER TO EITHER QUESTION 6 OR 7 IS NO, sign and date below and  
DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.**

**A Corrective Measures Work Plan must be submitted along with this form to address these issues.**

\_\_\_\_\_  
Signature of Owner, Remedial Party or Designated Representative

6-1-20  
\_\_\_\_\_  
Date



|                                                                                                                                                            |                                                                                                                                                     | <b>Box 2A</b>                       |                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------|
|                                                                                                                                                            |                                                                                                                                                     | YES                                 | NO                                  |
| 8.                                                                                                                                                         | Has any new information revealed that assumptions made in the Qualitative Exposure Assessment regarding offsite contamination are no longer valid?  | <input type="checkbox"/>            | <input checked="" type="checkbox"/> |
| <b>If you answered YES to question 8, include documentation or evidence that documentation has been previously submitted with this certification form.</b> |                                                                                                                                                     |                                     |                                     |
| 9.                                                                                                                                                         | Are the assumptions in the Qualitative Exposure Assessment still valid?<br>(The Qualitative Exposure Assessment must be certified every five years) | <input checked="" type="checkbox"/> | <input type="checkbox"/>            |
| <b>If you answered NO to question 9, the Periodic Review Report must include an updated Qualitative Exposure Assessment based on the new assumptions.</b>  |                                                                                                                                                     |                                     |                                     |

| <b>SITE NO. C224233</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                    | <b>Box 3</b>                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------------------------------------------|
| <b>Description of Institutional Controls</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                                                                           |
| <u>Parcel</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <u>Owner</u>                       | <u>Institutional Control</u>                                                              |
| 2443-6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | WBA Housing Development Fund Corp. | Soil Management Plan<br>Monitoring Plan<br>Site Management Plan<br>O&M Plan<br>IC/EC Plan |
| <p>The use of groundwater underlying the property is prohibited.</p> <p>Monitoring of the groundwater and soil vapor intrusion shall be in accordance with the SMP.</p> <p>Operation, Maintenance, and Monitoring of the SSDS and SVE shall be in accordance with the SMP.</p> <p>Compliance with a Soils Management Plan is necessary.</p> <p>Use of the site must be maintained as restricted-residential, commercial, or industrial.</p> <p>This is all in accordance with the Environmental Easement.</p> |                                    |                                                                                           |

|                                                                                                                                                                                                                                                                                          |                                                                                               | <b>Box 4</b> |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|--------------|
| <b>Description of Engineering Controls</b>                                                                                                                                                                                                                                               |                                                                                               |              |
| <u>Parcel</u>                                                                                                                                                                                                                                                                            | <u>Engineering Control</u>                                                                    |              |
| 2443-6                                                                                                                                                                                                                                                                                   | Sub-Slab Depressurization System<br>Cover System<br>Soil Vapor Extraction<br>Monitoring Wells |              |
| <p>There is a sub-slab depressurization system in place at the site.</p> <p>There is a soil vapor extraction system in place to prevent migration of soil vapor from west portion of the site.</p> <p>There is a cover system in place on the property to prevent exposure to soils.</p> |                                                                                               |              |



**Periodic Review Report (PRR) Certification Statements**

1. I certify by checking "YES" below that:

a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the Engineering Control certification;

b) to the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and the information presented is accurate and complete.

YES NO

X ☐

2. For each Engineering Control listed in Box 4, I certify by checking "YES" below that all of the following statements are true:

(a) the Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

(b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

(c) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control;

(d) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and

(e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.

YES NO

X ☐

**IF THE ANSWER TO QUESTION 2 IS NO, sign and date below and  
DO NOT COMPLETE THE REST OF THIS FORM. Otherwise continue.**

**A Corrective Measures Work Plan must be submitted along with this form to address these issues.**

\_\_\_\_\_  
Signature of Owner, Remedial Party or Designated Representative

\_\_\_\_\_  
Date

IC CERTIFICATIONS  
SITE NO. C224233

Box 6

**SITE OWNER OR DESIGNATED REPRESENTATIVE SIGNATURE**

I certify that all information and statements in Boxes 1, 2, and 3 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I Peter Proctor at LPC Development Group LLC, 496 E 173<sup>rd</sup> St  
print name print business address Brooklyn, NY 11237

am certifying as Owner (Owner or Remedial Party)

for the Site named in the Site Details Section of this form.

[Signature]  
Signature of Owner, Remedial Party, or Designated Representative  
Rendering Certification

6-1-20  
Date

## EC CERTIFICATIONS

Box 7

### Professional Engineer Signature

I certify that all information in Boxes 4 and 5 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I ANDREW LEVENBAUM at 424 NEW YORK AVE HUNTINGTON, NY 11743  
print name print business address

am certifying as a Professional Engineer for the OWNER  
(Owner or Remedial Party)



Signature of Professional Engineer, for the Owner or  
Remedial Party, Rendering Certification



12/7/2020  
Date