SITE MANAGEMENT PLAN

Active Industrial Uniform Co., Inc.
Suffolk County
Lindenhurst, New York

NYSDEC Site Number: 152125
US EPA ID #: NA

Prepared for:

New York State Department of Environmental Conservation
625 Broadway
Albany, NY, 12233

Prepared by:

HRP Associates, Inc.
197 Scott Swamp Road
Farmington, CT 06032

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

CERTIFICATION STATEMENT

I, **Derek Roy**, certify that I am currently a Qualified Environmental Professional as 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).

Signature of QEP

December 15, 2023
DATE

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List of Acronyms

AOC	Area of Concern
AS	Air Sparging
AST	Aboveground Storage Tank
COC	Certificate of Completion
CP	Commissioner Policy
CVOC	Chlorinated Volatile Organic Compound
D&B	D&B Engineers and Architects
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
EPA	U.S. Environmental Protection Agency
EWP	Excavation Work Plan
FEMA	Federal Emergency Management Agency
GAC	Granular Activated Carbon
GWE&T	Groundwater Extraction and Treatment
HRP	HRP Associates, Inc.
IC	Institutional Control
MIP	Membrane Interface Probe
NAPL	Non-Aqueous Phase Liquid
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
P.E.	Professional Engineer
PCE	Tetrachloroethylene
PFAS	Per- and Polyfluoroalkyl Substances
PRR	Periodic Review Report
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SCG	Standards, Criteria, and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
t-1,2-DCE	Trans-1,2-dichloroethylene

TCA	1,1,1-trichloroethane
TCE	Trichloroethylene
TOGS	Technical and Operational Guidance Series
USGS	United States Geological Survey
UST	Underground Storage Tank
VC	Vinyl Chloride
VISL	Vapor Intrusion Screening Level
VOC	Volatile Organic Compounds

1.0 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 (SMP):

Site Identification: 152125 Active Industrial Uniform Co., Inc., (Active Industrial Uniform) Suffolk County, Lindenhurst, New York.

Institutional Controls:	The property may be used for restricted residential, commercial, or industrial use.
	Deed restriction (i.e., Declaration of Covenant and Restrictions) including restrictions on soil excavation and other disturbance of onsite soil, and implementation of a groundwater use restriction for the property.
	The use of groundwater underlying the property is prohibited **without** necessary water quality treatment as determined by the NYSDOH or the Suffolk Department of Health 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 NYSDEC; 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 Deed Restriction (i.e., Declaration of Covenant and Restrictions); The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on **Figure 2**, and any potential impacts that are identified must be monitored or mitigated; Vegetable gardens and farming on the Site are prohibited.
Engineering Controls:	All ECs must be operated, maintained and inspected at a frequency and in a manner defined in the SMP.
	Routine monitoring of the groundwater monitoring well network
	[redacted] – As Needed

Inspections:	**Frequency**
1. Fire Safety Inspection	Monthly
Monitoring:	**Frequency**
2. Groundwater Monitoring Wells MW-101 through MW-108; MW-2S, MW4D, MW-5S, Recovery Wells RW-1 and RW-2	Every fifth quarter
Maintenance:	**Frequency**
1. Equipment with treatment shed	Monthly
2. Lawn Maintenance	Monthly
Reporting:	**Frequency**
1. Site Management Quarterly Report	Annual
2. Periodic Review Report	Every three years

Further descriptions of the above requirements are provided in detail in the latter sections of this SMP.

2.0 INTRODUCTION

2.1 General

This SMP is a required element of the remedial program for the Active Industrial Uniform facility located at 63 West Merrick Road (a.k.a. West Montauk Highway, or State Route 27A) in the Village of Lindenhurst, Suffolk County, New York (hereinafter referred to as the "Site"), (**Figure 1**). The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program, Site No. 152125, which is administered by the NYS Department of Environmental Conservation (NYSDEC).

Active Industrial Uniform entered into an Order of Consent on September 22, 1993, with NYSDEC to remediate the site. On March 31, 1999, a Record of Decision (ROD) was issued by NYSDEC, which outlined the remedial approach for the Site. A figure showing the site location and boundaries of this site is provided as **Figures 1** and **2**. The boundaries of the site are more fully described in the metes and bounds site description that is part of the April 2014 Declaration of Covenants and Restrictions 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 Controls (ICs)and Engineering Controls (ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment. A Declaration of Covenants and Restrictions granted to NYSDEC, and recorded with the Suffolk County Clerk, requires compliance with this SMP and all ECs and ICs.

This SMP was prepared to manage remaining contamination at the site until the requirements of the ROD are satisfied in accordance with ECL Article 71, Title 36. This plan has been approved by NYSDEC, and compliance with this plan is required under the order of consent. This SMP may only be revised with the approval of NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Declaration of Covenants and Restrictions. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC); and
- Failure to comply with this SMP is also a violation of Environmental Conservation Law (ECL), 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 and the Order of Consent for the site, and thereby subject to applicable penalties.

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

This SMP was prepared by HRP Associates, Inc. (HRP) in accordance with the requirements of NYSDEC's DER10 ("Technical Guidance for Site Investigation and Remediation"), dated May 3, 2010, and the guidelines provided by NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs.

2.2 Revisions and Alterations

Revisions and alterations to this plan will be proposed in writing to NYSDEC's project manager. The NYSDEC can also make changes to the SMP or request revisions from the remedial party (RP). Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shutdown of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. All approved alterations must conform with Article 145 Section 7209 of the Education Law regarding the application of professional seals and alterations. For example, any changes to as-built drawings must be stamped by a NYS Professional Engineer (P.E.). In accordance with the Declaration of Covenants and Restrictions for the site, the NYSDEC project manager will provide a notice of any approved changes to the SMP and append these notices to the SMP that is retained in its files.

2.3 Notifications

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

1. Sixty-day advance notice of any proposed changes in site use that are required under the terms of the Order of Consent, 6 NYCRR Part 375 and/or ECL.
2. Seven-day advance notice of any field activity associated with the remedial program.
3. Fifteen-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan (EWP; **Appendix C**). If the ground-intrusive activity qualifies as a change of use as defined in 6 NYCRR Part 375, the above mentioned 60-day advance notice is also required.
4. 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.
5. Notice within 48 hours of any non-routine maintenance activities.
6. 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.
7. Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to 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 (**Appendix B**):

1. At least 60 days prior to the change, NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/RP has been

provided with a copy of the Order of consent and all approved work plans and reports, including this SMP.

2. 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 NYSDEC.

Table 1 includes contact information for the above notifications. 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	Required Notification**
Jasmine Stefansky NYSDEC Project Manager	(518) 402-9575 Jasmine.stefansky@dec.ny.gov	All Notifications
Jeffrey Dyber NYSDEC Section Chief	(518) 402-9621 jeffrey.dyber@dec.ny.gov	All Notifications
Kelly Lewandowski NYSDEC Site Control	(518) 402-9553 Kelly.lewandowski@dec.ny.gov	Notifications 1 and 8
Sally Rushford NYSDOH Project Manager	(518) 402-5465 Sally.Rushford@health.ny.gov	Notifications 4, 6, and 7

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

** Note: Numbers in this column reference the numbered bullets in the notification list in this section.

3.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

3.1 Site Location and Description

The Active Industrial Uniform Site is located in the Village of Lindenhurst, Town of Babylon, Suffolk County, New York (**Figure 1**). The Site is comprised of three contiguous parcels, identified as District 103, Section 22, Block 1, and Lots 9.001, 9.002 and 25: associated Parcel IDs 0103-022.00-01.00-009.001, 0103-022.00-01.00-009.002, and 0103-022.00-01.00-025.000, respectively, on the Suffolk County Tax Map, with a total area of approximately 0.5 acres. The Site is bounded by West Montauk Highway (a.k.a. State Route 27A) to the north, Tompkins Lane, and residences to the south, and commercial properties to the east, and west (**Figure 2**). The boundaries of the site are more fully described in **Appendix A**. The owner of the Site parcels at the time of issuance of this SMP is Active Industrial Uniform.

The Site is listed on the NYS Registry of Inactive Hazardous Waste Sites and is subject to the 1997 ROD, discussed in **Section 2.3**.

3.2 Physical Setting

3.2.1 Land Use

The Site is currently vacant with a 35-foot-by-35-foot treatment shed housing the components of the inactive Groundwater Extraction and Treatment (GWE&T) system; the air stripping towers and carbon vessels associated with the system have been removed. A fence with locked gate surrounds the property. The northern parcel of the Site (0103-022.00-01.00-009.001) is zoned Business; the southeastern (0103-022.00-01.00-025.000) and southwestern (0103-022.00-01.00-009.002) parcels are zoned as residential.

Historically, the Site was occupied by a dry cleaner and laundry. The laundering operations were performed at the Site between 1945 and 1993; dry cleaning operations were conducted between 1970 and 1987. In June 1993, the laundering operation ceased, and the facility began operating as a distribution center. In May 1994, all operations of the Site had ceased. In February 1995, the onsite buildings were demolished.

The properties adjoining the Site, and in the neighborhood surrounding the Site, primarily include light commercial and residential properties. The properties immediately south of the Site include residential properties; the properties immediately north, east, and west of the Site include light commercial properties.

3.2.2 Geology

Long Island's geology is composed of the Monmouth Group, Matawan Group, and Magothy Formation, which is described as a sequence of unconsolidated glacial, lacustrine, deltaic, and marine deposits of clay, silt, and gravel that range in age from Upper Cretaceous to Pleistocene. These deposits overlay a Precambrian to Paleozoic crystalline bedrock.

The Matawan Group-Magothy Formation is overlain by the Monmouth Group, the Gardiners Clay, or upper Pleistocene deposits, depending on location. The Matawan Group-Magothy Formation is typically a gray and white, fine to coarse sand with some interstitial clay.

A geologic cross section is shown on **Figures 3a** and **3b**. Site-specific boring logs are provided in **Appendix D**.

3.2.3 Hydrogeology

The aquifers underlying the Site are comprised of coastal-plain deposits of continental and marine origin of Late Cretaceous age overlain by unconsolidated glacial deposits of Pleistocene age. These deposits are underlain by bedrock of Lower Paleozoic and/or Precambrian age. The Lloyd Aquifer overlays the crystalline bedrock and is poorly to moderately permeable. The Lloyd aquifer has been intruded by salty groundwater from over pumping, locally in necks near the north shore, where the aquifer is shallow and overlying clays are discontinuous.

The Raritan Clay located at 223 feet below mean sea level (approximately 300 feet beneath the Site) constitutes a confining unit for the Lloyd Aquifer preventing the impact by contaminants from the overlying Upper Glacial formation. The deep Upper Glacial Aquifer constitutes the principal aquifer for public-supply in eastern Queens, most of Nassau, and western/central Suffolk counties. Wells screened in the basal zone of the aquifer yield as much as 1,400 gallons per minute (gpm). The deep Upper Glacial Aquifer has also been invaded by salt water from over pumping locally in southwestern Nassau and southern Queens County and in small areas along the north shore.

The Upper Glacial Aquifer has been impacted by industrial and municipal activities and is vulnerable to impacts by contaminants.

The shallow, intermediate, and deep portions of the Upper Glacial Aquifer were evaluated during this investigation. These zones correspond to the saturated portions of the shallow, intermediate and deep Upper Glacial Formation. The shallow Upper Glacial Aquifer is defined as the first groundwater encountered within the Upper Glacial Aquifer and generally occurs between 15 feet above mean sea level and 20 feet below mean sea level. The intermediate Upper Glacial Aquifer is the zone directly above the North Shore Confining Unit and generally occurs between 20 and 70 feet below mean sea level. The North Shore Confining unit may be discontinuous across the Site and separates the shallow/intermediate Upper Glacial Aquifer from the deep Upper Glacial Aquifer. The North Shore Confining unit generally occurs between 70 and 100 feet below mean sea level. The deep Upper Glacial Aquifer is the zone below the North Shore Confining Unit and generally occurs below 100 feet below mean sea level.

Based on the previous investigations conducted by others, subsurface soils consist primarily of fine to coarse sand with varying amounts of gravel. There is a confining clay layer approximately 70 feet below ground surface (ft bgs). The direction of groundwater flow in the area is predominantly to the south-southwest. The depth-to-water onsite is approximately 8 to 10 ft bgs. The nearest surface water body is Little Neck Creek, located approximately 800 feet southwest of the Site. The nearest public water supply well, United States Geological Survey (USGS) Well#404124073241601, is located approximately 1.7 miles to the north.

A groundwater contour map is included as **Figure 4**, and groundwater monitoring well construction logs are provided in **Appendix D**.

3.3 Investigation and Remedial History

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**.

An initial soil and groundwater investigation, conducted in 1987, identified chlorinated volatile organic compounds (CVOCs) in soil and groundwater at the Site associated with the storage and use of dry-cleaning solvents. One former underground storage tank (UST), and two aboveground storage tanks (ASTs) containing tetrachloroethylene (PCE) were identified as the source of contamination, and several USTs were reported to have been removed from the Site between 1985 and 1987.

In 1990, a soil gas survey was performed onsite to define the nature and extent of CVOC contamination. Elevated concentrations of PCE, trichloroethylene (TCE), 1,1,1-trichloroethane (TCA), and trans-1,2-dichloroethylene (t-1,2-DCE) were detected. The highest detections of impacts were identified in the vicinity of the former PCE UST (northwest corner), downgradient of the former PCE UST (southwest corner), and in the area south of the main building onsite. An offsite soil gas survey was conducted in June 1991.

A soil vapor extraction (SVE) system was installed in 1991 to remove the source areas identified in the 1990 soil vapor survey and to prevent migration of soil vapor to offsite areas. The SVE system began operations in July 1991.

From October 1993 to April 1994, a Remedial Investigation (RI) was conducted to define the nature and extent of contamination. Soil sampling, groundwater monitoring well installation, and sampling of the abandoned drywells, septic tank and associated cesspool was completed on Site. Surface water and sediment sampling were performed to investigate whether the Little Neck Creek (approximately 800 feet southwest of the Site) was impacted as a result of the release. However, the findings of that report were not provided in available records, and additional sampling has not been completed. Offsite soil gas monitoring and ambient air testing were also conducted during the RI.

The RI identified shallow (less than 30 feet below grade) and deep (approximately 30 to 70 feet below grade) groundwater plumes, extending in a southerly direction toward Little Neck Creek. Maximum PCE concentrations in the shallow groundwater plume were reported at 20 milligrams per liter (mg/L) and migrating to the south-southwest. The deep groundwater plume is believed to migrate more to the south following the slope of a clay confining layer at approximately 70 ft bgs. The maximum concentration of PCE in soil was 40,000 milligrams per kilogram (mg/kg) in the onsite dry wells and cesspool, and around the former PCE USTs. The highest concentration of PCE collected from Little Neck Creek was 8 micrograms per liter (µg/L), and relatively low as compared to the nearest groundwater sample collected from the monitoring well on Shore Road. Detected concentrations of chlorinated compounds in indoor air were below the level of public health concern (*Record of Decision*, 1997).

Record of Decision, NYSDEC, March 1997

The ROD outlined the remedial approach for the Active Industrial Uniform inactive hazardous waste disposal Site which was chosen in accordance with the NYS ECL. The NYSDEC has selected the following remedial components for the Site:

- Continued operation of the existing SVE system to remediate shallow soil contamination in the source area and expansion of the system to treat contaminated soil in the area of the dry wells/cesspools on the north side of the Site and under portions of the former building;
- Removal of volatile organic compounds (VOCs) from the SVE system emissions by activated carbon;
- Installation of an air-sparging system to remediate shallow onsite groundwater;
- Installation of a GWE&T system downgradient of the Site to capture, remove, and treat dry cleaning compounds detected in the shallow groundwater in the downgradient surrounding area, and treatment of the groundwater by air stripping; and discharge of the treated effluent to the storm sewer;
- Environmental monitoring of groundwater existing upgradient, onsite and downgradient of the Site and periodic reviews of clean up goals; and
- Implementation of a deed restriction, including restrictions on soil excavation and other disturbance of onsite soil, and implementation of a groundwater use restriction for the property.

Following the selection of the remedial approach outlined in the March 1997 ROD, Phase I/Phase II Remedial Design Investigations were completed in July to December 1998 to assess concentrations and distribution of VOCs on and offsite.

The 1998 onsite soil and groundwater investigations targeted the dry wells/cesspools. Results indicated onsite cesspools were a significant source of contamination. The highest concentrations of chlorinated VOCs were identified in soil samples within the footprint of the cesspools in the southern portion of the Site. PCE concentrations up to 760 mg/kg were detected between 0 to 4 ft bgs in soil in the southern portion of the site Additionally, elevated concentrations total xylenes, were identified in soil on the southern portion of the property, with a maximum detection of 62 mg/kg; the source of xylenes was not identified.

In onsite groundwater collected via Geoprobe sampling, the maximum concentration of PCE was from the western portion of the site at 26,000 µg/L collected from 10 to 16 ft bgs. In offsite groundwater, the maximum concentration of PCE was located southwest of the site at a concentration of 20,000 µg/L, collected from 12 to 16 ft bgs. Little Neck Creek was determined to be the discharge point for the contaminant plume where low levels of PCE were identified in the surface water during the 1993-1994 RI.

In November 2000, approximately 600 cubic yards of contaminated soil from the northeastern and southeastern portions of the Site were excavated and disposed offsite. Eleven drywells/cesspools and associated contaminated soil were also excavated and disposed offsite. The SVE system was dismantled and the SVE shed was razed on November 29, 2000.

To confirm if any soil contamination remained onsite following excavation, two rounds of soil boring sampling via direct push were performed in 2001. Fifteen soil samples were collected and analyzed for VOCs. Results indicated that excavation removed the sources of contamination. Therefore, the planned air sparging (AS) system was not installed. The NYSDEC concluded if any residual contamination remained onsite, installation of an onsite extraction well (RW-1) pumping at a rate of 100 gpm, would create a "capture zone" to capture any contamination that would have otherwise been addressed by the AS system, which was outlined in a letter dated February 5, 2001.

A GWE&T remedial system was installed in Fall 2001, for hydraulic control of the groundwater plume and to capture and treat residual groundwater contamination, which included the installation of onsite recovery well (RW-1) and an offsite recovery well (RW-2) Eleven groundwater monitoring wells were installed to monitor the groundwater quality, eight onsite and three offsite (downgradient). The goal of the operation of this system was to lower the concentrations of dissolved VOCs to levels below NYSDEC clean-up objectives. The onsite recovery well and monitoring well locations are depicted on **Figure 2**, the entire on and offsite well network is presented on **Figure 4**.

Baseline groundwater sampling occurred in the summer of 2001 prior to the installation of the GWE&T, which occurred in the Fall of 2001. Baseline groundwater samples were analyzed for VOCs and the analytical results for onsite wells were detected at concentrations greater than NYSDEC's ambient groundwater quality standards. The highest concentration of PCE was 958 µg/L in MW-104, on the western side of the Site. The highest concentrations of total VOCs were detected in monitoring wells MW-105 and MW-106 (12,104 µg/L and 1,245 µg/L, respectively). No exceedances of NYSDEC's groundwater standards were detected in offsite monitoring wells, with the exception of cis-1,2-dichloroethene in MW-110 (8.5 µg/L).

In February 2005, the Site was placed on the List of Inactive Hazardous Waste Sites.

A Soil Vapor Intrusion (SVI) Evaluation was conducted in 2006. Four grab groundwater and soil gas samples were collected onsite, and one grab groundwater and soil gas sample were collected offsite, approximately 200 feet to the southwest. Elevated concentrations of CVOCs, including cis-1,2-DCE and vinyl chloride (VC), were detected in a grab groundwater sample collected near the southeastern portion of the Site, and PCE and 1,2-DCE, were detected from two soil gas samples along the southern boundary of the Site. The NYSDEC and NYS Department of Health (NYSDOH) determined additional SVI and groundwater sampling was necessary. SVI was also necessary for residential homes to the south of the site to evaluate potential vapor intrusion. The 2006 Vapor Intrusion Evaluation Report completed by O`Brian and Gere was not available for review.

In November 2007 and January 2008, a follow up SVI investigation was conducted to evaluate the findings from the April 2006 SVI study. The investigation included eleven soil vapor samples collected from onsite and offsite locations, sub-slab air samples from eight offsite structures, seven groundwater samples from previously installed monitoring wells, and two soil samples. The investigation findings are briefly summarized below:

- Elevated site-specific VOCs were detected in onsite soil gas, with PCE concentrations as high as 740,000 micrograms per cubic meter (µg/m^3) detected in the western portion of the Site. This finding confirmed a presence of residual contamination in shallow soil at the Site;
- Concentrations of chlorinated solvents in offsite soil gas were significantly lower (e.g., PCE less than 340 µg/m^3) than the samples collected along the southern Site boundary (PCE greater than 4,000 µg/m^3) and generally declined with increasing distance from the Site;
- Indoor air samples collected in two of the eight nearby offsite locations exhibited PCE concentrations in exceedance of its applicable NYSDOH indoor air guidance criteria. In addition, the sub-slab vapor sample collected from one residence located immediately south of the Site exhibited PCE concentrations in sub-slab vapor sufficient to require "mitigation," based on the applicable NYSDOH indoor air guidance criteria. Based on these sampling results, NYSDEC has since installed an active soil vapor mitigation system within the basement of this structure (located at [redacted]) to manage sub-slab vapor;
- Elevated concentrations of site-specific VOCs, including PCE and cis-1,2-DCE, were detected in groundwater samples collected from onsite groundwater monitoring wells MW-104 and MW-106, and offsite groundwater monitoring well MW-2S. The highest PCE concentration was detected in the groundwater sample collected from monitoring well MW-104 (77 µg/L). However, the VOC concentrations across the majority of the Site have demonstrated a significant decline since the onset of the groundwater treatment activities when the greatest PCE concentration at the Site was detected at 958 µg/L in MW-104.
- Elevated concentrations of PCE, TCE and cis-1,2-DCE were detected in a soil sample collected from 3 ft bgs in the western portion of the Site.

In 2010, while excavating a trench during an investigation into a blockage in the treatment system effluent pipe, two USTs (one 2,000 reportedly used for #2 fuel oil, and one 550-gallon used as a wash water holding tank/cesspool), and piping were identified on the western portion of the Site. It appeared that the USTs may have been abandoned in place between 1985 and 1987 but is unclear why they were not removed during previous UST removal activities. Two dry wells and several below grade drainage structures, including a buried floor drain, trap, valve, and piping, were also identified. Excavation of the USTs and drainage features occurred in 2010. Approximately 300 to 360 cubic yards of soil were excavated. Excavated soil was remediated onsite utilizing ex-situ technology. Onsite ex-situ soil remediation was accomplished by loading soil into an enclosure equipped with a pressure blower; the blower was piped into the GWE&T systems carbon vessels and ran until sampling of the soil met the requirements of the Unrestricted Soil Cleanup Objectives (SCOs), and the soil reused on site as fill.

In April 2010, extraction well RW-2 was shut down due to historically low VOC concentrations per NYSDEC direction. Issues were additionally encountered with the use of RW-2. Attempts to redevelop the well made by the previous consultants were not successful and it was concluded that the screen at RW-2 had collapsed.

In June to July 2011, additional soil investigation and remediation activities were performed in the southwestern portion of the Site; 380 cubic yards of soil were removed along with three dry wells and associated piping.

In 2013 to 2014, an onsite source area assessment and temporary well plume re-delineation program was completed at the Site, which included a remedial alternatives study and a membrane interface probe (MIP) investigation, including the collection of targeted groundwater samples. Based on the recommendations presented in the 2015 MIP Investigation Summary Report, D&B Engineers and Architects (D&B) prepared a draft chemical injection pilot study scope of work. Neither the MIP report nor the injection proposal were available for review.

In April 2017, an evaluation of groundwater monitoring data indicated an increasing trend in contaminant concentrations in the influent of the GWE&T system. This increase was suspected to be due to the GWE&T system intercepting deeper onsite contamination. D&B recommended that an evaluation be completed regarding continued operation of the GWE&T system in addition to implementation of a source area investigation to evaluate possible areas of remaining contamination at the Site. To facilitate these remedial system optimization (RSO) activities, it was recommended to keep the GWE&T system off to allow for the subsurface environment to come to equilibrium prior to completing the proposed work. Quarterly groundwater monitoring was performed historically and through the RSO activities to monitor for rebound in concentrations of Site constituents of concern.

The NYSDEC approved the shutdown of the system and on November 30, 2018, the system was shutdown. The RSO activities were reportedly completed by D&B; however, a copy of that report is not available and the results of the RSO activities are unknown. The associated air stripping towers were dismantled and removed in 2020. The system has remained off since November 2018.

Following the shutdown of the GWE&T system in 2018, concentrations of CVOCs have shown a general stable to decreasing trend in concentrations. Onsite wells MW-4D, MW-104, and MW-106 represent the highest groundwater concentrations observed onsite. Concentrations of PCE, TCE, and cis-1,2-DCE have shown a fluctuating but decreasing trend in MW-104; concentrations of PCE, TCE, and cis-1,2-DCE show fluctuating and relatively stable trends in MW-106; concentrations of PCE and TCE show a decreasing trend in MW-4D, a stable trend of cis-1,2-DCE, and an increasing trend of VC. Offsite and downgradient monitoring well MW-2S shows fluctuating and relatively stable trends for PCE, TCE, cis-1,2-DCE, and VC. **Figure 6** presents the groundwater analytical data from the fourth quarter of 2019 (Q4 2019) through Q2 2023.

3.4 Remedial Goals

The Remedial Goals for the Site as listed in the ROD dated March 27, 1997, are as follows.

- Reduce, control, or eliminate to the extent practicable the contamination present within the soils on site;
- Eliminate the threat to surface waters by remediating to the extent practicable contaminated groundwater;
- Eliminate the potential for direct human or animal contact with the contaminated soils on site;

- Mitigate the impacts of contaminated groundwater to the environment;
- Prevent, to the extent possible, migration of contaminants;
- Provide for attainment of Standards, Criteria, and Guidelines (SCGs) for groundwater quality at the limits of the area of concern (AOC) to the extent practicable; and
- Reduce the threat to homes from high groundwater.

The GWE&T system was shut down on November 30, 2018 (**Section 3.3.1**) and has remained off since. Extraction well RW-2 was shut down in April 2010 due to historically low VOC concentrations per NYSDEC direction. Issues were encountered with the use of RW-2; therefore, attempts were made to redevelop the well. Redevelopment was not possible, and it was concluded that the screen at RW-2 had collapsed and was not able to be repaired. Recovery wells RW-1 and RW-2 were added to the groundwater monitoring plan following system shut down.

Due to groundwater analytical results either at concentrations less than the NYSDEC Class GA Groundwater Standard or not detected above the laboratory reporting limits and given that RW-2 is damaged it is recommended to discontinue sampling of RW-1 and RW-2 following the April 2023 groundwater monitoring event.

3.5 Remaining Contamination

The historical onsite dry-cleaning operations caused wide-spread soil and groundwater contamination with PCE and its degradation products. Site-specific contaminants of concern include PCE, TCE, cis-1,2-DCE, and VC. Some other VOCs were also reported at the Site, including TCA and t-1,2-DCE.

3.5.1 Soil

As discussed above, the soil at the Site is contaminated with chlorinated VOCs. In addition, petroleum hydrocarbons were also detected in soils associated with the 2,000-gallon UST used for storage of #2 fuel oil and abandoned in place in the 1980s.

The Site underwent several iterations of soil remediation, summarized in **Section 2.3**. The most recent soil remediation was conducted in 2010, when the areas of two USTs, drainage features, several drywells, and associated soil were remediated. The excavation area encompassed approximately 4,200 square feet, which included the USTs and drainage features, and extended to 2 to 12 ft bgs. Approximately 300 to 360 cubic yards of soil were excavated from the UST area. At the time of investigation, the following exceedances were detected in soil:

Table 2 summarizes the results of the most current soil data that exceed the SCOs after completion of the remedial action (2010).

Table 2: Remaining Contamination in Soil (2010)

Soil Sample ID	Sampling interval, feet	Site-Specific Contaminant of Concern Concentrations, mg/kg				Diesel Range Organics, mg/kg
		PCE	TCE	Cis-1,2-DCE	VC	
SS-04	Surface	**190**	**4.3 J**	<11	<11	NS
	3	**14.0**	0.290	<0.580	<0.580	NS
SS-09	3.5	**5.0**	0.120	<0.580	<580	NS
	6	**7.8**	0.100	<0.530	<0.530	NS
SS-10	3	**240**	**7.9 J**	<14	<14	NS
B-03	0-2	**2,100**	**34**	**20**	<120	NS
2,000-gall fuel oil UST	bottom samples	NS	NS	NS	NS	34
SS-20	7.5	0.120	0.360	**1.7**	0.027	NS
North Side Wall sample	--	**2.1**	0.063	0.033	ND	NS
Drum EP	7.5 feet	**30**	0.310	0.290	ND	NS
Unrestricted Use SCO	--	*1.3*	*0.47*	*0.25*	*0.02*	*Not established*

Notes:

1	Parameter reported at a concentration greater than the Unrestricted Use SCO
<1	not detected above laboratory reporting limit

mg/kg = milligrams per kilogram

J = Estimated

ND = Not detected

NS = Not sampled

Samples SS-04, SS-09, and SS-10 were collected as pre-characterization samples to pre-determine the excavation limits. In an effort to address these identified exceedances, the excavation at these locations was advanced several feet in each direction, including vertically. However, additional confirmatory samples were not collected to evaluate whether the identified exceedances were fully remediated.

An additional soil investigation was conducted on the site in September 2019 and included test pits installation as part of RSO activities. The D&B Site Management Quarterly Report No. 60 for Q4 2019 site activities stated that at the completion of RSO activities an RSO summary report will be completed. While a report for this work does not appear to have been prepared at the time, it was indicated that no significant source of contamination was identified during test pit activities. However, it is understood that some remaining soil contamination, which may include non-aqueous phase liquid (NAPL), may be present in the vicinity of MW-4D. The area of inferred remaining soil exceedances is depicted on **Figure 5**.

3.5.2 Sediment

As mentioned in **Section 2.3**, sediment sampling was performed to investigate whether Little Neck Creek was impacted by contamination originating at the subject Site. However, the findings of that report were not provided in available records, and additional sampling has not been completed.

3.5.3 Groundwater

Table 3 summarizes the results of the most current groundwater that exceed the SCGs after completion of the remedial action (April 2023).

Table 3 – Remaining Contamination in Groundwater (April 2023)

Monitoring Well ID	Site-Specific Contaminant of Concern Concentrations, µg/L			
	PCE	TCE	Cis-1,2-DCE	VC
MW-2S (offsite)	**8.7**	3.2	**34**	**2.2**
MW-4D (onsite)	**5.2**	**93**	**210**	**120**
MW-5S (onsite)	0.48	<1	<1	<2
MW-101 (onsite)	0.84	0.3	<1	<2
MW-102 (onsite)	0.55	<1	<1	<2
MW-103 (onsite)	3.5	0.58	<1	<2
MW-104 (onsite)	**20**	2.4	<1	<2
MW-105 (onsite)	4.8	0.64	0.39	**2.1**
MW-106 (onsite)	**12**	2.5	3	<2
MW-107 (onsite)	1.6	<1	<1	<2
MW-108 (onsite)	2.2	<1	<1	<2
MW-109 (offsite)	<1	0.42	<1	<2
MW-111 (offsite)	<1	<1	<1	<2
RW-1 (onsite)	<1	<1	<1	<2
RW-2 (offsite)	<2	<2	<2	<4
Class GA Groundwater Standard, µg/L	5.0	5.0	5.0	2.0

1	Parameter reported at a concentration greater than the Class GA Groundwater Standard
<1	not detected above laboratory reporting limit; µg/L = micrograms per liter

Onsite groundwater monitoring wells (MW-4D, MW-104, and MW-106) exhibited one or more of the site-specific VOCs at concentrations exceeding their respective Class GA Groundwater Standards during the April 2023 sampling event. PCE was detected in eleven of the fifteen sampled groundwater monitoring wells at concentrations ranging from 0.48 µg/L (in MW-5S) to a maximum of 20 µg/L (in MW-104). However, PCE only exceeded the Class GA Standard of 5 µg/L in four of the fifteen groundwater monitoring wells. Of the two sampled offsite wells (MW-2S and RW-2), MW-2S exhibited a concentration of PCE at 8.7 µg/L. **Figure 6** presents the groundwater data between Q4 2019 to Q2 2023.

Following the shutdown of the GWE&T system in 2018, concentrations of CVOCs have shown a general stable to decreasing trend in concentrations. Onsite wells MW-4D, MW-104 and MW-106, located along the southern property boundary, represent the highest groundwater concentrations observed onsite and MW-2S represents the highest offsite impacts, a brief summary of the trends is below.

MW-4D: PCE has shown a decreasing trend since 2018 with a maximum concentration of 67,000 µg/L in Q1 2018 to 5.2 µg/L in Q2 2023. TCE has shown a decreasing trend since 2018 with a maximum concentration of 5,800 µg/L in Q1 2018 to 93 µg/L in Q2 2023; cis-1,2-DCE has shown a decreasing trend with a maximum concentration of 490 µg/L in Q1 2018 to 210 µg/L in Q2 2023; VC has shown fluctuations in concentrations but an overall increasing trend since 2018 with a concentration of 67 µg/L in Q1 2018 to 120 µg/L in Q2 2023.

MW-104: PCE has shown a fluctuating but general decreasing trend since 2018 with a maximum concentration of 44 µg/L in Q2 2018 to 20 µg/L in Q2 2023. TCE has shown a general decreasing trend and has been above the GA Water Quality Standards only twice in twelve sampling events since 2018; cis-1,2-DCE has shown a fluctuating but overall decreasing trend and has been below the GA Water Quality Standards since Q4 2020; VC has not been detected above the laboratory RL since Q2 2020.

MW-106: PCE has shown a fluctuating but general stable trend since 2018 with a concentration of 10 µg/L in Q1 2018 to 12 µg/L in Q2 2023, with a maximum concentration of 15 µg/L in Q3 2020. TCE has shown a general decreasing trend and has been above the GA Water Quality Standards only twice in twelve sampling events since 2018; cis-1,2-DCE has shown a decreasing trend with a maximum concentration of 1,200 µg/L in Q2 2018 to 3 µg/L in Q2 2023; VC has shown a decreasing trend with a maximum concentration of 58 µg/L in Q2 2018 to non-detect in Q2 2023.

MW-2S: PCE has shown a fluctuating and relatively stable trend since 2018 with a concentration of 13 µg/L in Q1 2018 to 8.7 µg/L in Q2 2023, with a maximum concentration of 29 µg/L in Q3 2020. TCE has shown a stable to decreasing trend and has been above the GA Water Quality Standards only twice in twelve sampling events since 2018; cis-1,2-DCE has shown a decreasing trend with a maximum concentration of 2,300 µg/L in Q2 2018 to 34 µg/L in Q2 2023; VC has shown a slight increasing trend since 2018 with 1.9 µg/L in Q2 2018 to 2.2 µg/L in Q2 2023, with a maximum concentration of 11 µg/L in Q2 2020.

3.5.4 Surface Water

In 1993-1994, surface water sampling was performed to investigate whether Little Neck Creek was impacted by the contamination originating at the subject Site. The findings of that report were not available for review. However, the results of surface water sampling were briefly summarized in the 2006 ROD. The highest concentration of PCE collected from Little Neck Creek was 8 µg/L, and relatively low as compared to the nearest groundwater sample collected from the monitoring well on Shore Road. No additional sampling has been completed.

3.5.5 Soil Vapor

Table 4 below summarizes the results of the December 2007 and January 2008 soil vapor samples, and **Figures 6a** and **6b** present soil vapor exceedances and the areas of soil vapor concern at the Site, respectively.

Table 4: Remaining Soil Vapor Contamination							
Soil Vapor sampling ID	Site-Specific Contaminant of Concern Concentrations, µg/m³						
	PCE	TCE	Cis-1,2-DCE	VC	TCA	Trichlorofluoromethane	Benzene
SV-V1S	16,000	1,200	77		200	5.6	
SV-V2S	6,600	4,000	3,400		51	18	
DP-01	740,000	20,000	1,600		700		27
DP-02	4,000	310	320		2.1	1.3	11
DP-03	310	64	2		50	1.6	6.6
DP-04	62,000	8,200	21,000	14	3.6		3.8
DP-05	54					1.1	
DP-06	340			56			1,500
DP-07			8.3	2.4			380
DP-08	11				1.9	1.2	21
DP-09	5.1					0.71	3.4

Note: Table shows detected values

In addition, several offsite structures were sampled during this investigation. Five of the sampled structures included sub-slab soil vapor and indoor air sample sets and were used to compare to the NYSDOH guidance matrices (M01, M03, M04, M05 and M07). Two compounds, PCE and carbon tetrachloride were reported in indoor air at levels above NYSDOH indoor air guidance values at M04, and due to the results of the investigation, a sub-slab depressurization (SSD) system was installed in 2009 at the residence located at [redacted] to address offsite vapor intrusion concerns.

Certain contaminants including PCE, TCE, and VC are typically detected in groundwater samples collected from onsite monitoring wells. Concentrations of these contaminants were compared to Vapor Intrusion Screening Levels (VISLs) using the U.S. Environmental Protection Agency's (EPA) VISL calculator. Target groundwater concentrations were calculated assuming commercial use of the site for PCE (24.2 µg/L), TCE (2.18 µg/L), and VC (2.45 µg/L). Concentrations of PCE, TCE, and/or VC exceeded these values in monitoring wells MW-4D, MW-014, MW-105, and MW-106. The inferred area of potential vapor intrusion concern is depicted on **Figure 7**. While concentrations of VOCs exceed the calculated VISLs for groundwater in this area, there is no structure located within this portion of the site, and the IC discussed under **Section 3.0** prevents use of the site for purposes other than operation of a GWE&T system.

4.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

4.1 General

Since remaining contamination exists at the site, ICs and 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 project manager.

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 controls to be evaluated during each required inspection and periodic review;
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC project manager.

4.2 Institutional Controls

A series of ICs is required by the ROD to implement, maintain and monitor EC systems. These ICs are:

- 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 NYSDOH or the Suffolk County Department of Health 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 Declaration of Covenant and Restrictions recorded in the DEED records on April 28, 2014

- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on **Figure 9**, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited.

ICs in the form of a groundwater use restriction and land-use restriction are mandatory controls required for the Site as per the March 1997 ROD. ICs consisting of a Declaration of Covenant and Restrictions, including groundwater and land-use restrictions, was recorded on April 28, 2014, in the Deed records of the Suffolk County Clerk's office and the Village of Lindenhurst. There is no onsite use of groundwater for potable purposes and the use of the property has been and will continue to be restricted to operation of the GWE&T system only.

4.3 Engineering Controls

An EC is defined as any physical barrier or method designed to minimize the potential for human exposure to contamination by either limiting direct contact with contaminated areas or controlling migration of contaminants through environmental media. All ECs must be operated, inspected, and maintained as specified in this SMP. Groundwater and other environmental or public health monitoring must be performed as defined in this SMP. Data and information pertinent to Site Management of the Controlled Property must be reported at the frequency and in a manner defined in this SMP.

4.3.1 GWE&T System

ECs existing at the Site include the GWE&T system and the routine monitoring of the groundwater monitoring well network, as required by the March 1997 ROD (**Section 2.4**). The goal of the operation of this system is to lower the concentrations of dissolved VOCs to levels that are below NYSDEC clean-up objectives.

The GWE&T system was shut down on November 30, 2018, based on the monitoring data which indicated an increasing trend in contaminant concentrations in the influent of the GWE&T system. It was believed at the time that this increase may have been due to the GWE&T system intercepting deeper onsite contamination. The system was shut down to allow the subsurface to equilibrate prior to completion of RSO activities and investigations. Further investigation of the site was conducted in 2019 but did not identify any additional source material in the areas where test pits were installed. The GWE&T system has remained off since November 2018, and the associated air stripper dismantled removed from the site.

The GWE&T system was constructed in 2001 and replaced the previously used SVE system. The design of the complete groundwater recovery and treatment system includes the following items:

- The GWE&T system consists of two 4-inch diameter extraction wells each equipped with a submersible pump. Extraction well RW-1 is located onsite in the southwestern portion and recovers groundwater at a rate of 80 gpm. Recovery well RW-2 is located offsite on Orchard Street, approximately 500 yards to the southwest; it was designed to recover groundwater at a rate of 100 gpm.

- The recovered groundwater is pumped to the treatment system housed in a system remediation building.
- Inside the remediation building, the groundwater recovery lines are connected to two air stripping towers. The air stripping towers remove VOCs from the groundwater by moving large quantities of air from the bottom of the tower to the top while the water is pumped to the top of the tower and allowed to cascade to the bottom.
- The treated water then undergoes filtration and gets discharged into a storm water catch basin located on Shore Road, which then discharges the treated water into Little Neck Creek, in accordance with all applicable discharge standards.
- The system's air discharge passes through an air/moisture separator and then passed through two 5,000-pound vapor phase granular activated carbon (GAC) vessels, connected in series, and then discharged to the atmosphere through an emissions stack.
- Air stripper tower packing requires periodic maintenance (i.e., cleaning by means of feeding hydrochloric acid through towers), due to the iron, manganese, and calcium carbonate accumulations.

Extraction well RW-2 was shut down in April 2010 due to historically low VOC concentrations per NYSDEC direction. The well remained in the quarterly groundwater monitoring program. It should be noted that the well screen at RW-2 had previously collapsed. HDR conducted an inspection in 2020 and made an attempt to re-develop the well, which was not successful. Additionally, RW-1 is currently off-line as approved by NYSDEC in 2018 but was added to the routine groundwater sampling plan in 2018.

In July 2011, due to low concentrations of VOC within the vapor-phase effluent and in order to increase the efficiency of the overall GWE&T system, the air stripper exhaust piping was reconfigured to bypass the GAC vessels and discharge directly to the atmosphere. These modifications were performed with the approval of NYSDEC.

4.3.2 SSD System

An SSD system was installed at the residence located at [redacted] due to the results of previous vapor intrusion investigations conducted at the Site. The system was designed to mitigate potential VOCs from migrating through the floor slab of the building into indoor air. The system incorporates a fan and piping to move vapors in soil from beneath the building slab to the outside of the building. The system components include polyvinyl chloride (PVC) piping, a fan, an extraction point, and a u-tube manometer. The fan pulls vapors from the piping beneath the building and discharges those vapors through a vent installed above the roofline of the building. The manometer measures pressure in the system piping, verifying that the system is operating correctly.

Procedures for operating and maintaining the SSD system are documented in the Operation and Maintenance (O&M) Plan (**Section 5.0**). As-built drawings are included in the Sub-Slab Ventilation System Installation Report in **Appendix E**. **Figure 10** shows the location of the ECs for the Site.

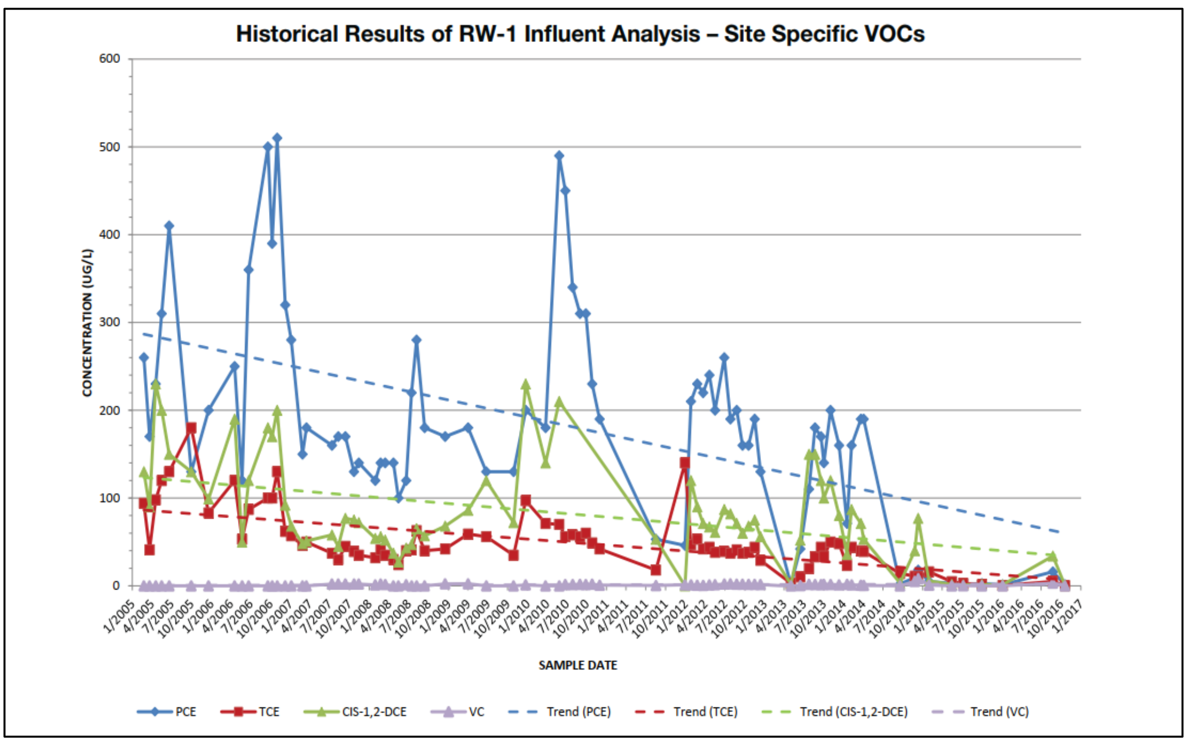
4.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

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

As discussed below, NYSDEC may approve termination of a groundwater monitoring program. When a RP receives this approval, the RP will decommission all site-related monitoring, injection and recovery wells as per NYSDEC Commissioner Policy (CP)-43 policy.

The RP will also conduct any needed site restoration activities, such as asphalt patching and decommissioning treatment system equipment. In addition, the RP will conduct any necessary restoration of vegetation coverage, trees and wetlands, and will comply with NYSDEC and U.S. Army Corps of Engineers regulations and guidance. Also, the RP will ensure that no ongoing erosion is occurring on the site.

The graph below, obtained from the 2016 Periodic Review Report (PRR) by D&B, depicts the concentrations of PCE, TCE, cis-1,2-DCE and VC in extraction well RW-1 between 2005 and 2016. All site-specific VOC contaminants of concern have exhibited generally decreasing trends since 2005.



Source: *2016 Periodic Review Report*. D&B, June 2017.

4.3.3.1 GWE&T System

As previously noted in **Section 3.3.1**, to facilitate RSO activities the GWE&T system was shut down on November 30, 2018, as approved by Payson Long of NYSDEC, and documented in the D&B, P.C. Site Management Quarterly Report #56. Following RSO activities and the evaluation of groundwater analytical results showing decreasing trends, the system was not restarted and has remained off since; the air stripper and carbon vessels have been removed. The system is planned for decommissioning.

4.3.3.2 SSD System

The SSD system will not be discontinued unless prior written approval is granted by the NYSDEC and NYSDOH project managers. If monitoring data indicates that the SSD system may no longer be required, a proposal to discontinue the SSD system will be submitted by the RP to the NYSDEC and NYSDOH project managers.

5.0 MONITORING AND SAMPLING PLAN

5.1 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 project manager. 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 (QAPP) 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 SCGs, particularly groundwater standards; 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.

5.2 Site-Wide Inspection

Site-wide inspections will be performed monthly or a minimum of once per year. These periodic inspections must be conducted when the ground surface is visible (i.e., no snow cover). Site-wide inspections will be performed by a qualified environmental professional (QEP) as defined in 6 NYCRR Part 375 or P.E. licensed to practice in NYS. Modification to the frequency or duration of the inspections will require approval from the NYSDEC project manager. 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 G**. 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;

- Whether stormwater management systems, such as basins and outfalls, are working as designed;
- 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 PRR. 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.

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 project manager 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 QEP, as defined in 6 NYCCR Part 375. Written confirmation must be provided to the NYSDEC project manager 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. The RP will submit follow-up status reports to NYSDEC within 45 days of the event on actions taken to respond to any emergency event requiring ongoing responsive action, describing, and documenting actions taken to restore the effectiveness of the ECs.

5.3 Treatment System Monitoring and Sampling

As discussed in **Section 3.3.3.1**, as approved by the NYSDEC Project Manager, the system was turned off in November 2018 to facilitate RSO activities. Following RSO activities and the evaluation of groundwater analytical results showing decreasing trends, the system was not restarted and has remained off since. No sampling of the treatment system is planned, and the system is planned for decommissioning.

5.4 Post-Remediation Media Monitoring and Sampling

Samples shall be collected from the monitoring wells on a routine basis. Sampling locations and required analytical parameters and schedule are provided in **Table 5** below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 5: Groundwater Sampling Requirements and Schedule				
Sampling Location	**Sampling Frequency**	**Analytical Parameters**		
	Every Fifth Quarter	**VOCs (EPA Method 8260)**	**PFAS (EPA Method 1633)**	**1,4-Dioxane (EPA Method 8270)**
MW-101	X	X	X	X
MW-102	X	X	X	X
MW-103	X	X	X	X
MW-104	X	X	X	X
MW-105	X	X	X	X
MW-106	X	X	X	X
MW-107	X	X	X	X
MW-108	X	X	X	X
MW-109	X	X	X	X
MW-111	X	X	X	X
RW-1	X	X	X	X
RW-2	X	X	X	X
MW-2S	X	X	X	X
MW-4D	X	X	X	X
MW-5S	X	X	X	X

PFAS = per- and polyfluoroalkyl substances

VOCs = volatile organic compounds

Detailed sample collection and analytical procedures and protocols are provided in **Appendices F** and **H**.

Groundwater samples will be submitted for analysis to an Environmental Laboratory Approval Program (ELAP)-certified laboratory. Procedures for chain of custody, laboratory instrumentation calibration, laboratory analyses, reporting of data, internal quality control, and corrective actions shall be followed as per SW-846 and as per the laboratory's QAPP. Where appropriate, trip blanks, field blanks, field duplicates, and matrix spike, matrix spike duplicate shall be performed at a rate of five percent and will be used to assess the quality of the data. The laboratory's in-house quality assurance/quality control (QA/QC) limits will be utilized whenever they are more stringent than those suggested by the EPA methods.

5.4.1 Soil Sampling

Soil sampling is not anticipated but may be performed to assess the quality of the soil following completion of the remedial actions. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

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

Deliverables for the soil sampling program are specified in **Section 7.0**.

5.4.2 Groundwater Sampling

To monitor groundwater quality and to ensure the selected remedy was effective, a quarterly groundwater sampling program was implemented at the Site and was sampling performed quarterly up to January 2022. Based on an assessment of quarterly groundwater data, NYSDEC concluded that the groundwater sampling frequency can be reduced. The frequency of sampling was reduced from quarterly to every fifth quarter as of January 7, 2022. The first Q5 sampling event was performed in April 2023.

The network of monitoring wells has been installed to monitor upgradient, onsite and downgradient groundwater conditions at the site. The network of onsite and offsite wells has been designed based on the following criteria:

The monitoring well network includes four sentinel wells that monitor downgradient plume migration. Sentinel wells are uncontaminated wells located directly downgradient of the plume and upgradient of sensitive receptors. The monitoring well sampling plan includes the following sentinel wells: MW-2S, MW-109, MW-111, and RW-2.

Table 6 summarizes the wells' identification numbers, location, depths, diameter, and screened intervals of the wells. As part of the groundwater monitoring, eleven onsite wells and four downgradient wells are sampled to evaluate the effectiveness of the remedial system. The RP will measure depth to the water table for each monitoring well in the network before sampling.

Table 6: Monitoring Well Construction Details

Monitoring Well ID	Well Location	Well Diameter (inches)	Screen top, ft bgs	Screen bottom, ft bgs
MW-101	Northern corner of Site	2	5	15
MW-102	Northern side of Site	2	5	15

Table 6: Monitoring Well Construction Details				
Monitoring Well ID	**Well Location**	**Well Diameter (inches)**	**Screen top, ft bgs**	**Screen bottom, ft bgs**
MW-103	Off western corner of treatment building	2	5	15
MW-104	Western side of Site	2	5	15
MW-105	Off southern corner of treatment building	2	5	15
MW-106	SE corner of Site	2	5	15
MW-107	Southern side of Site	2	5	15
MW-108	SW portion of Site	2	5	15
MW-109	Offsite: 0.35 miles SW, corner of Orchard St and Shore Rd	2	25	35
MW-111	Offsite: 0.1 miles SW, Lane St	2	25	35
MW-2S	Offsite: 200 ft south, Tompkins St	2	12	22
MW-4D	SW portion of Site	4	60	70
MW-5S	Western side of Site	2	14	24

Monitoring well construction logs are included in **Appendix D** of this document, and the well network and sampling locations are presented on **Figures 4a** and **4b**.

If biofouling or silt accumulation occurs in the onsite and/or offsite 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 project manager 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 PRR. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC project manager. 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 project manager.

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

Deliverables for the groundwater monitoring program are specified in **Section 7.0**.

5.4.3 Soil Vapor Sampling

Soil vapor sampling is not anticipated at this time but may be performed to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

The network of on and offsite soil vapor sample locations consists of eleven exterior soil vapor sampling points installed to assess soil gas vapor in relation to the remedy, and samples analyzed for TO-15. **Figure 6b** presents the soil gas sampling locations and results for PCE sampled in 2007.

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

Deliverables for the soil vapor sampling program are specified in **Section 7.0**.

5.4.4 SVI Sampling

SVI sampling is not anticipated but may be performed to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

The network of on and offsite SVI sample locations consists of the sampling of 8 structures for SVI via sub-slab, basement, and first floor indoor air samples, installed to assess the performance of the remedy, and samples analyzed for TO-15. **Figure 6a** presents the SVI sample locations and sampling results from 2007.

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

Deliverables for the SVI sampling program are specified in **Section 7.0**.

5.4.5 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in **Appendix G**. Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional details regarding monitoring and sampling protocols are provided in the Site-Specific Work Plan provided as **Appendix H** of this document.

6.0 OPERATION AND MAINTENANCE PLAN

6.1 General

This O&M 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 O&M Plan:

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

Further details regarding the O&M of the SSD system are provided in **Appendix E**. A copy of this Report, along with the complete SMP, is to be maintained at the site.

6.1.1 O&M of the SSD System

The following sections provide a description of the operations and maintenance of the SSD system. Cut-sheets and as-built drawings for the SSD system are provided in **Appendix E**.

6.1.2 SSD System Start-Up and Testing

The system components include PVC piping, a fan, an extraction point, and a u-tube manometer. The fan pulls vapors from the piping beneath the building and discharges those vapors through a vent installed above the roofline of the building. The manometer measures pressure in the system piping, verifying that the system is operating correctly. The manometer should be checked by the property occupant on a quarterly basis (every three months) to verify that the system is operating correctly. A reading of zero indicates that the system has failed. Any reading significantly less than the original reference reading of 2.6 water column (W.C.) indicates degradation in performance of the system. If any issues with the system are identified, then the property occupant should contact the NYSDEC project manager to arrange a visit and system inspection.

The system monitoring described above will be conducted if, in the course of the SSD system lifetime, the system goes down or significant changes are made to the system and the system must be restarted.

6.1.3 Routine SSD System O&M

The manometer should be checked by the property occupant on a quarterly basis (every three months) to verify that the system is operating correctly. A reading of zero indicates that the system has failed. Any reading significantly less than the original reference reading of 2.6 W.C. indicates degradation in performance of the system. If any issues with the system are identified, then the property occupant should contact the NYSDEC project manager to arrange a visit and system inspection.

Procedures for operating and maintaining the SSD system are documented in the O&M Plan (**Section 5.0**). As built drawings are included in the Sub-Slab Ventilation System Installation Report in **Appendix E**.

6.1.4 Non-Routine SSD System O&M

The NYSDEC may perform and audit of the system to evaluate system performance. The Audit may include the following:

- Inspection of the manometer;
- Inspection of the extraction point to ensure that is remains sealed;
- Inspection of the piping and vent stack for crack/leaks;
- Inspection of the fan and rubber mounts for leaks;
- Inspection of the electrical connection and test of the cut-off switch by turning the switch on and off; and
- Collection of air samples while the fan is operating and idle.

6.1.5 SSD System Monitoring Devices and Alarm

There is a manometer located in the basement of the building, which measures pressure inside the SSD system piping. The SSD system is monitored by the property occupant. There is no alarm associated with this system. Any issues with the functionality of the system are indicated by the manometer reading. Operational problems will be noted in the PRR to be prepared for that reporting period.

6.1.6 Fire Safety

Fire extinguishers are located in the treatment building and tagged with the most recent inspection. Inspections occur on a monthly basis and are certified on an annual basis.

Smoke alarms are installed in the treatment building. Regular maintenance includes battery replacement annually. The smoke alarms are tested monthly.

Emergency exits are clearly marked with emergency signs, with emergency lighting provided for exit routes. An annual 90-minute test is conducted annually, and a 30-second test is conducted monthly on the emergency lighting. The batteries in the emergency exit signs and lighting are replaced as needed.

The EPA treatment building does not have a fire sprinkler system as the building does not have a water supply.

7.0 PERIODIC ASSESSMENTS/EVALUATIONS

7.1 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 annual assessments, and briefly summarizes the vulnerability of the site and/or ECs to severe storms/weather events and associated flooding.

The following potential vulnerabilities will be assessed during periodic reviews:

- Flood Plain: According to the federal Emergency Management Agency (FEMA) Flood Maps Service Center[1], the site is located in the area of minimal flood hazard (Zone X). The nearest flood zone is located approximately 350 feet to the west. Recovery well RW-2 is located within the area of a one percent annual chance of flooding. However, it should be noted that RW-2 was shut down in April 2010 due to historically low VOC concentrations. Additionally, the screen at RW-2 has collapsed and the well is no longer in use. Periodic reviews of the FEMA flood maps will be conducted and included in the annual PRR.
- Site Drainage and Storm Water Management: Visual evaluations will be made on the site following severe weather events to determine the effectiveness of the site's storm water management system and the site's continued groundwater recharge capabilities.
- Erosion: Visual evaluations will be made on the site following severe weather events to identify any evidence of erosion at the site or areas of the site which may be susceptible to erosion during periods of severe rain events.
- High Wind: Certain site features are susceptible to damage during high winds including trees, fencing, air stripper towers, and the site building. Damage to the air stripper towers or building will not impact the function of the remediation system, as the system has been shut down, and the air stripper towers have been decommissioned. Visual inspections of these features will be performed following severe weather events to identify any potential damage that requires repairs.
- Electricity: Power is currently supplied to the building for lighting; however, the remediation system has been shut down and the air stripping towers have been decommissioned. Function of emergency and exit lighting is conducted regularly as part of the monthly fire safety inspections.

[1] FEMA Flood Map Service Center. Federal Emergency Management Agency. Accessed March 16, 2021, https://msc.fema.gov

- Spill/Contaminant Release: The remediation system is currently off, and remediation waste is no longer generated at the site. Regular inspections of the remaining remediation system equipment will continue to be performed on a monthly basis during the monthly fire safety inspections. If any new waste is generated or stored during any future site activities, the waste will be appropriately stored, protected from adverse weather, and properly disposed of within a reasonable time frame.

The following photographs depict the vulnerable areas of the site:

	
western portion of property	**eastern side of treatment building**
	
western portion of treatment building	**Equipment within remediation building**

7.2 Green Remediation Evaluation

The NYSDEC 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.

Electric Usage

The GWE&T system currently obtains 100 percent (%) of its electricity from the local electric utility, PSEG Long Island (PSEG). Based on the 2019 data, PSEG supplied electricity from a variety of fuel sources, including fossil fuels (46%), nuclear (11%), refuse burning (4%) and renewables (3%). The remaining 35% of its electricity was supplied from other outside electric utilities. Electricity usage associated with the GWE&T system while operating was an average of 174 kilowatt hours per day. Currently, since the GWE&T system is off, the main electricity usage is attributed to building and Site lighting, building HVAC and system controls. Electricity usage will be taken into consideration when choosing the next remedial approach for the Site.

Fossil Fuel Usage

Fossil fuels (i.e., natural gas) are used for the operation of the heaters in the treatment building. In addition, fossil fuels are used during the completion of maintenance and monitoring activities at the Site, including the following:

- Transportation to/from the Site for monitoring, sampling, and maintenance;
- Operation of a portable generator to power a submersible pump for groundwater sampling activities;
- Offsite transportation and shipment of samples collected for laboratory analysis; and
- Lawn maintenance operations.

Water Usage

The water usage at the Site is minimal and is associated with completion of maintenance of the GWE&T system and groundwater monitoring activities. The GWE&T system is not currently operating.

Air Emissions

Since the shut-down of the GWE&T system, only minor emissions to the air are generated through combustion of fossil fuels, as discussed above.

Consumption of Materials and Generation of Waste

Monitoring, maintenance and reporting activities result in material consumption and waste generation, including the following:

- Personal protective equipment;
- Polyethylene tubing, glassware, packaging material, and ice associated with groundwater sampling activities; and
- Maintenance parts.

7.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal RSO, or at any time that the NYSDEC project manager feels appropriate (e.g., during significant maintenance events or in conjunction with storm recovery activities).

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

8.0 REPORTING REQUIREMENTS

8.1 Site Management Reports

All site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in **Appendix G**. These forms are subject to NYSDEC revision. All site management inspection, maintenance, and monitoring events will be conducted by an environmental professional as defined in 6 NYCRR Part 375 or P.E. licensed to practice in NYS.

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 NYSDEC in accordance with the requirements of **Table 7** and summarized in the PRR.

Table 7: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Site Inspection	Monthly
Periodic Review Report	Every 3 years, or as otherwise determined by the Department
Operations and Maintenance Reports	annual, or as otherwise determined by the Department

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

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);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation);
- 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 NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

8.2 Periodic Review Report

A PRR will be submitted to the Department every three years or at another frequency as may be required by the NYSDEC project manager. In the event that the site is subdivided into separate parcels with different ownership, a single PRR will be prepared that addresses the site described in **Appendix A**. 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 PRR. 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, fire inspections and severe condition inspections, if applicable.
- Description of any change of use, import of materials, or excavation that occurred during the certifying period.

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.

Identification of any wastes generated during the reporting period, along with waste characterization data, manifests, and disposal documentation.

- 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 tables and figures will include a presentation of past data as part of an evaluation of contaminant concentration trends, including but not limited to:
    - Trend monitoring graphs that present groundwater contaminant levels from before the start of the remedy implementation to the most current sampling data;
    - Trend monitoring graphs depicting system influent analytical data on a per event and cumulative basis;
    - O&M data summary tables;
    - A current plume map for sites with remaining groundwater contamination; and
    - A groundwater elevation contour map for each gauging event.
- 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 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.
    - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;
    - An evaluation of trends in contaminant levels in the affected media to determine if the remedy continues to be effective in achieving remedial goals as specified by the Remedial Action Work Plan (RAWP), ROD or Decision Document; and – The overall performance and effectiveness of the remedy.

8.2.1 Certification of ICs and ECs

Following the last inspection of the reporting period, a QEP as defined in 6 NYCRR Part 375 or P.E. licensed to practice in NYS will prepare, and include in the PRR, 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*
> - *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, EA Engineering, Science, and Technology, Inc., of 269 West Jefferson St., Syracuse NY, 13202 am certifying as Remedial Partry's Designated Site Representative for the site."*

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

> *"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.*
- *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, H EA Engineering, Science, and Technology, Inc., of 269 West Jefferson St., Syracuse NY, 13202, am certifying as the Designated Site Representative for the site."

8.3 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 EC or failure to conduct site management activities, a Corrective Measures Work Plan will be submitted to the NYSDEC project manager 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 project manager.

8.4 Remedial System Optimization Report

If an RSO is to be performed (**Section 6.3**), upon completion of an RSO, an RSO report must be submitted to the NYSDEC project manager for approval. A general outline for the RSO report is provided in **Appendix I**. 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 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 and NYSDOH project managers.

9.0 REFERENCES

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

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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).

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2017 Periodic Review Report (January 2017 through December 2017). Dvirka and Bartilucci Consulting Services. May 2018.

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Site Management Quarterly Report No. 60 (October 2019 through December 2019). Dvirka and Bartilucci Consulting Services. January 2020.

FIGURES

0 1,000 2,000 4,000 6,000 8,000 Feet

1 inch = 2,000 feet

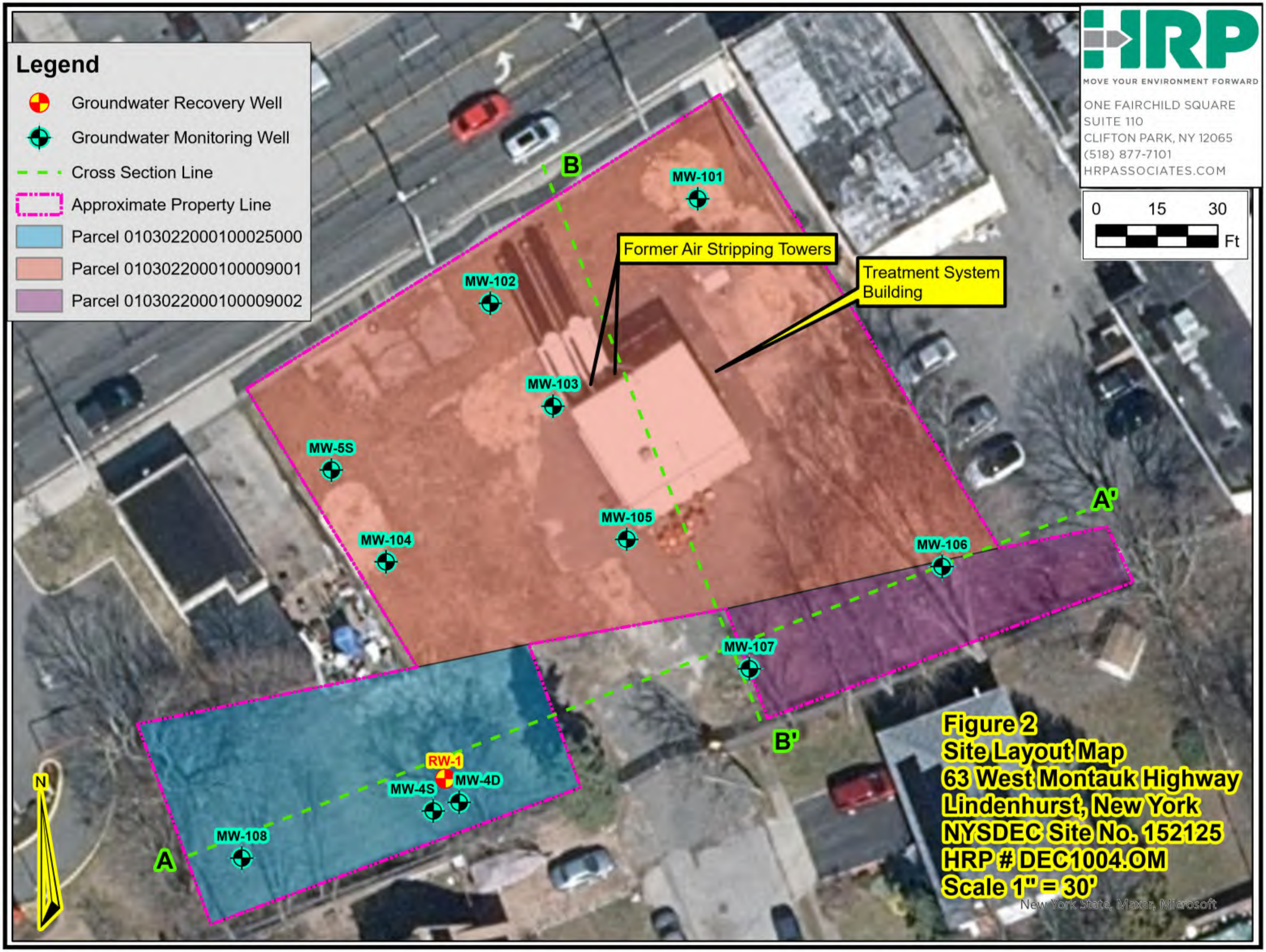
N

Figure 1
Site Location
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125
HRP # DEC1004.OM
Scale 1" = 2,000'

USGS Quadrangle Information
Quad ID: 40073-F3
Name: Bay Shore West, New York
Date Rev: 1978
Date Pub: 1979

HRP
MOVE YOUR ENVIRONMENT FORWARD
ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM

Path: S:\Data\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\GIS\Figure 1 - 63 West Montauk.mxd



Legend
Groundwater Recovery Well
Groundwater Monitoring Well
Cross Section Line
Approximate Property Line
Parcel 0103022000100025000
Parcel 0103022000100009001
Parcel 0103022000100009002
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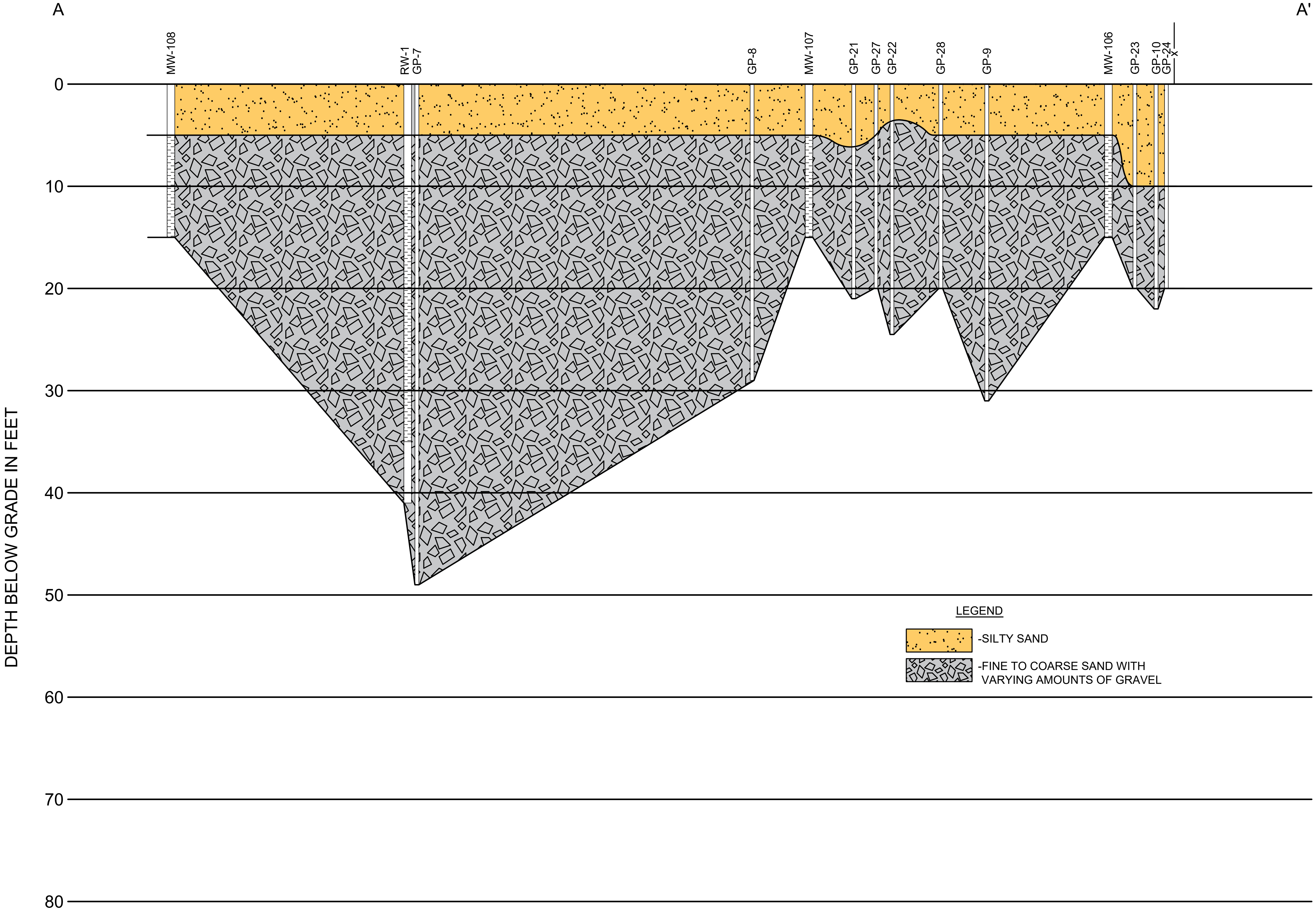
0 15 30
Ft
Former Air Stripping Towers
Treatment System Building
B
MW-101
MW-102
MW-103
MW-5S
MW-104
MW-105
MW-106
A'
MW-107
B'
RW-1
MW-4D
MW-4S
MW-108
A
N
Figure 2
Site Layout Map
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125
HRP # DEC1004.OM
Scale 1" = 30'
New York State, Maxar, Microsoft



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197 SCOTT SWAMP ROAD
FARMINGTON, CT 06032
(860) 674-9570
HRPASSOCIATES.COM

0 10' 20'
HORIZ. SCALE 1" = 20'

0 5' 10'
VERT. SCALE 1" = 10'

REVISIONS	
NO.	DATE

DESIGNED BY: DJF
DRAWN BY: BOB
REVIEWED BY: DJF

ISSUE DATE: 11/13/2020
PROJECT NUMBER: DEC1004.WM
SHEET SIZE: 11"x17"

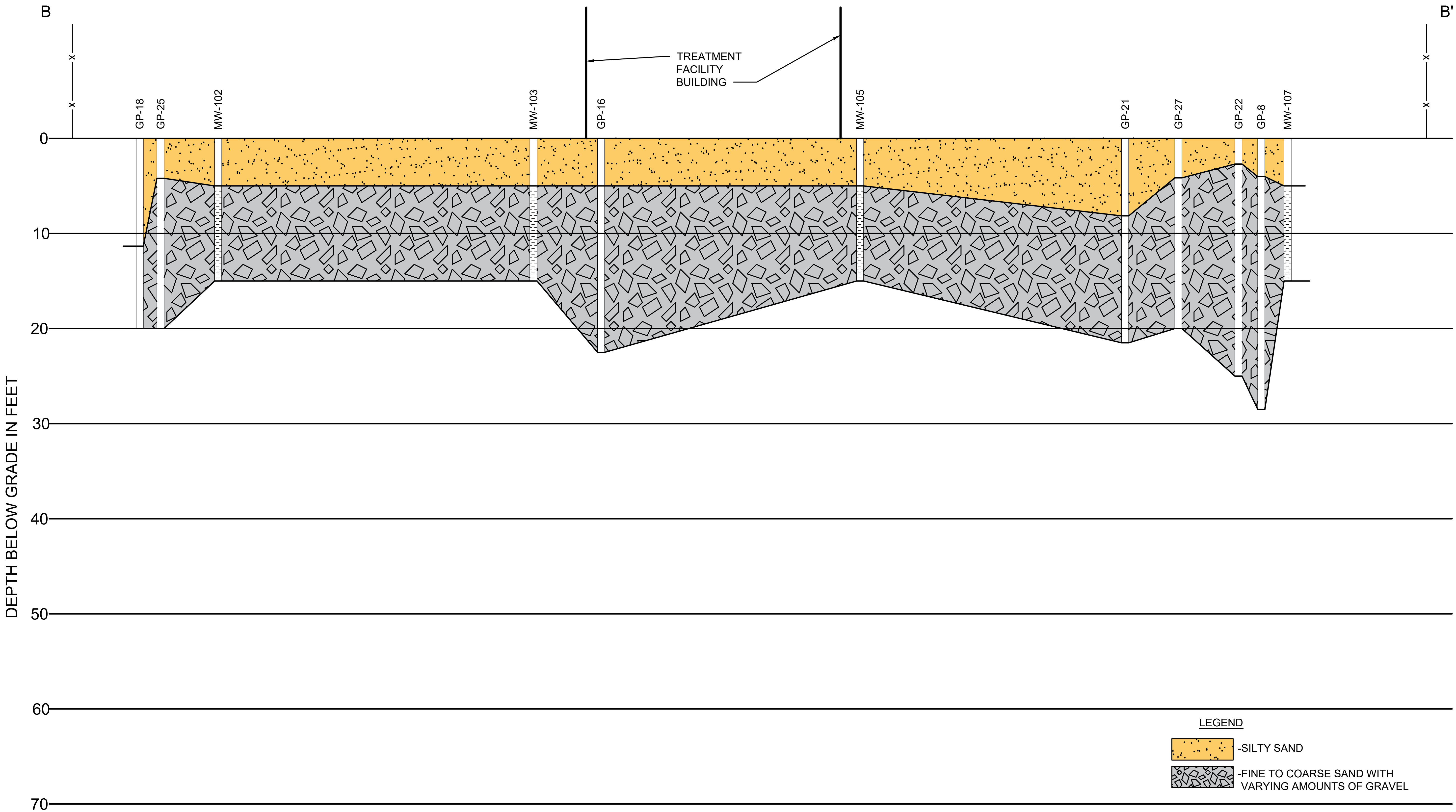
GENERALIZED GEOLOGIC CROSS SECTION A-A'

63 WEST MERRICK ROAD
BABYLON, NEW YORK

SHEET NO.

Fig. 3A

DRAWING NAME: S:\Data\N\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\CAD\Geologic Cross Sections.dwg LAYOUT: A-A' PLOT DATE: Dec 08, 2020 - 10:20am OPERATOR: BOB



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0 5' 10'
HORIZ. SCALE 1" = 10'

0 5' 10'
VERT. SCALE 1" = 10'

REVISIONS	
NO.	DATE

DESIGNED BY:	REVIEWED BY:	ISSUE DATE:
ASI	DJF	11/13/2020
DRAWN BY:	PROJECT NUMBER:	SHEET SIZE:
BOB	DEC1004.OM	11"x17"

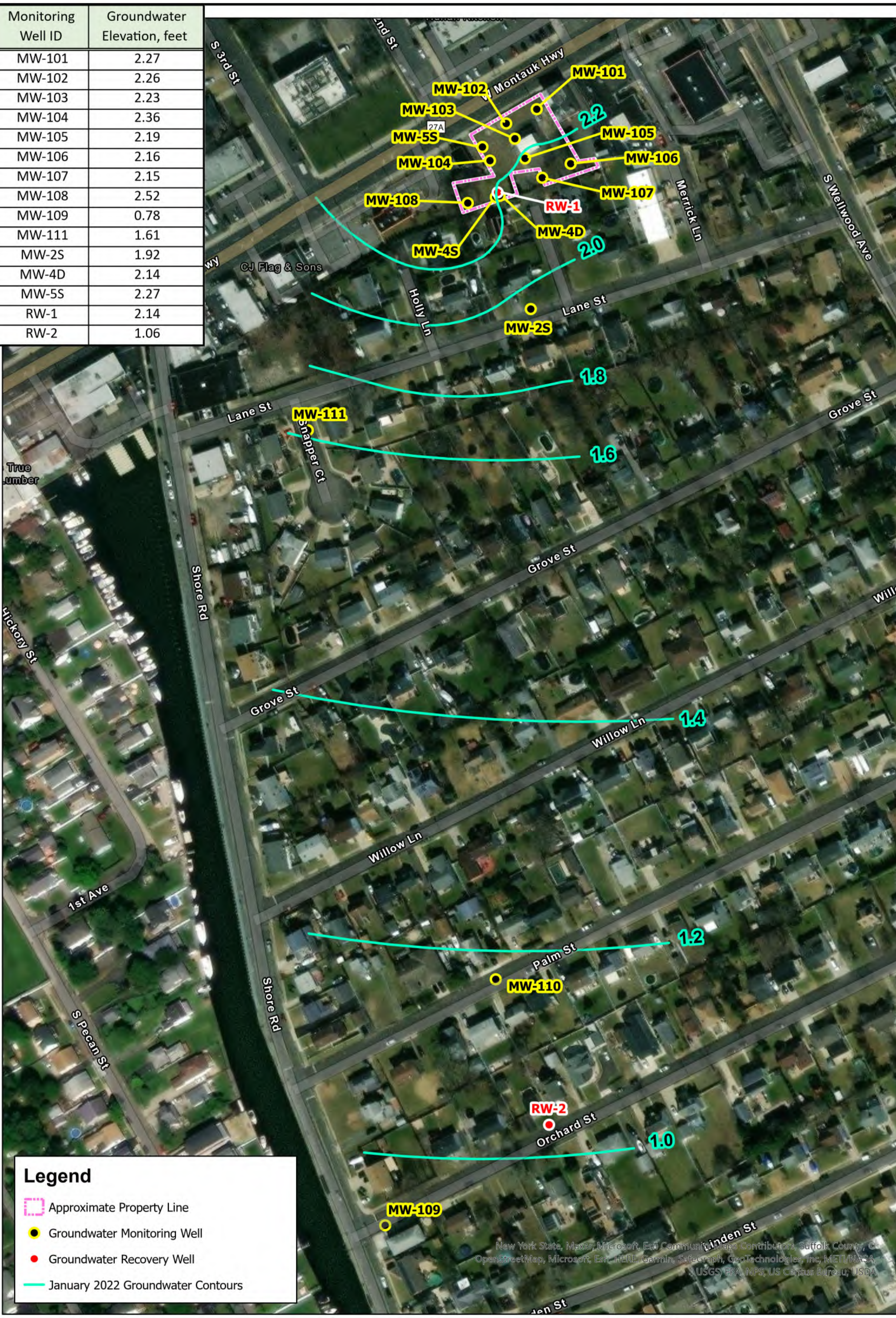
GENERALIZED GEOLOGIC CROSS SECTION B-B'

63 WEST MERRICK ROAD
BABYLON, NEW YORK

FIGURE NO.
3B

DRAWING NAME: S:\Data\N\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\CAD\Geologic Cross Sections.dwg LAYOUT: B-B' PLOT DATE: Dec 08, 2020 - 9:51am OPERATOR: BOB

Monitoring Well ID	Groundwater Elevation, feet
MW-101	2.27
MW-102	2.26
MW-103	2.23
MW-104	2.36
MW-105	2.19
MW-106	2.16
MW-107	2.15
MW-108	2.52
MW-109	0.78
MW-111	1.61
MW-2S	1.92
MW-4D	2.14
MW-5S	2.27
RW-1	2.14
RW-2	1.06



Legend

- Approximate Property Line
- Groundwater Monitoring Well
- Groundwater Recovery Well
- January 2022 Groundwater Contours

HRP
MOVE YOUR ENVIRONMENT FORWARD

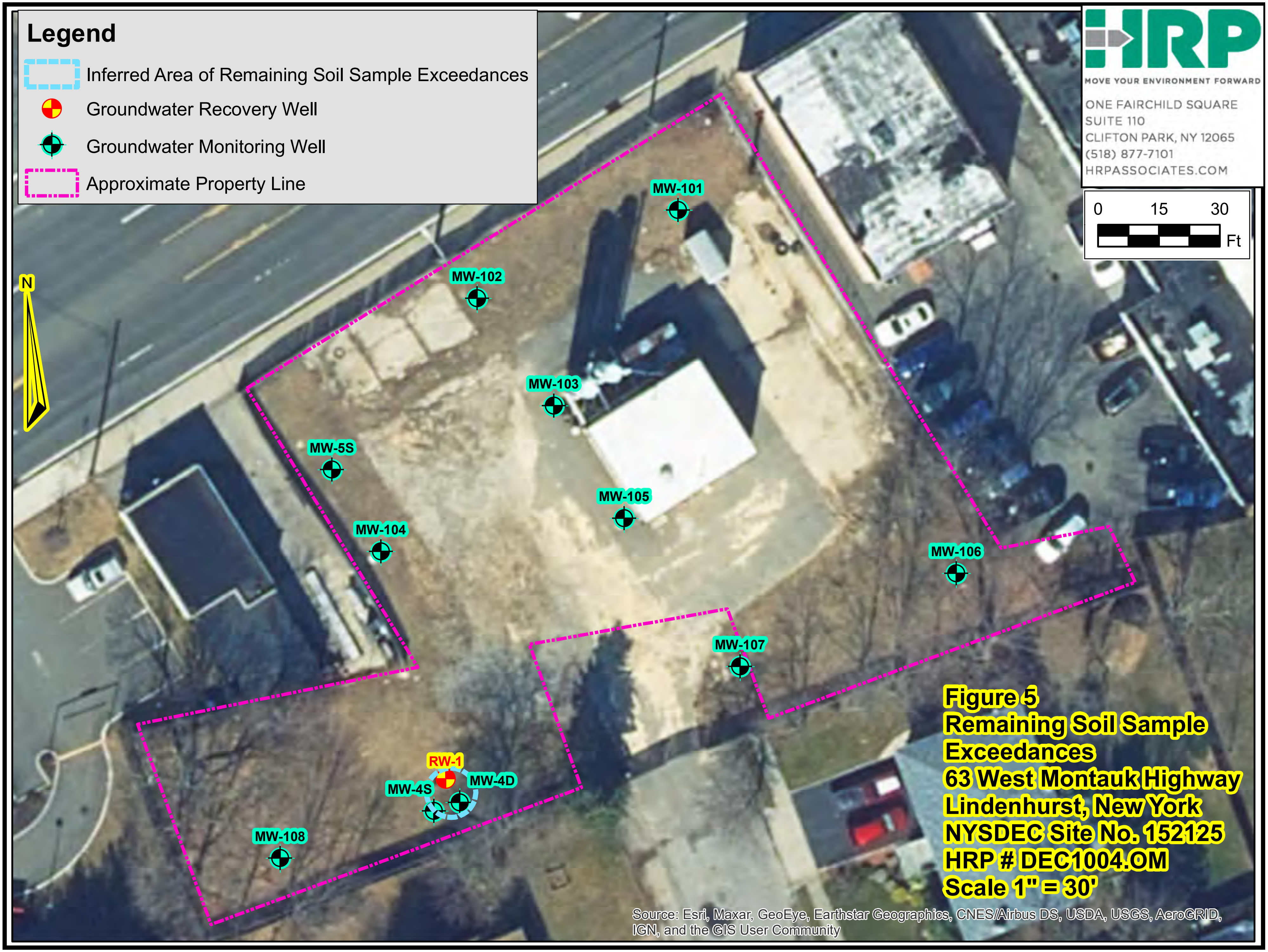
197 SCOTT SWAMP ROAD
FARMINGTON, CT 06032
(860) 674-9570
HRPASSOCIATES.COM

January 2022
Groundwater Contour Map

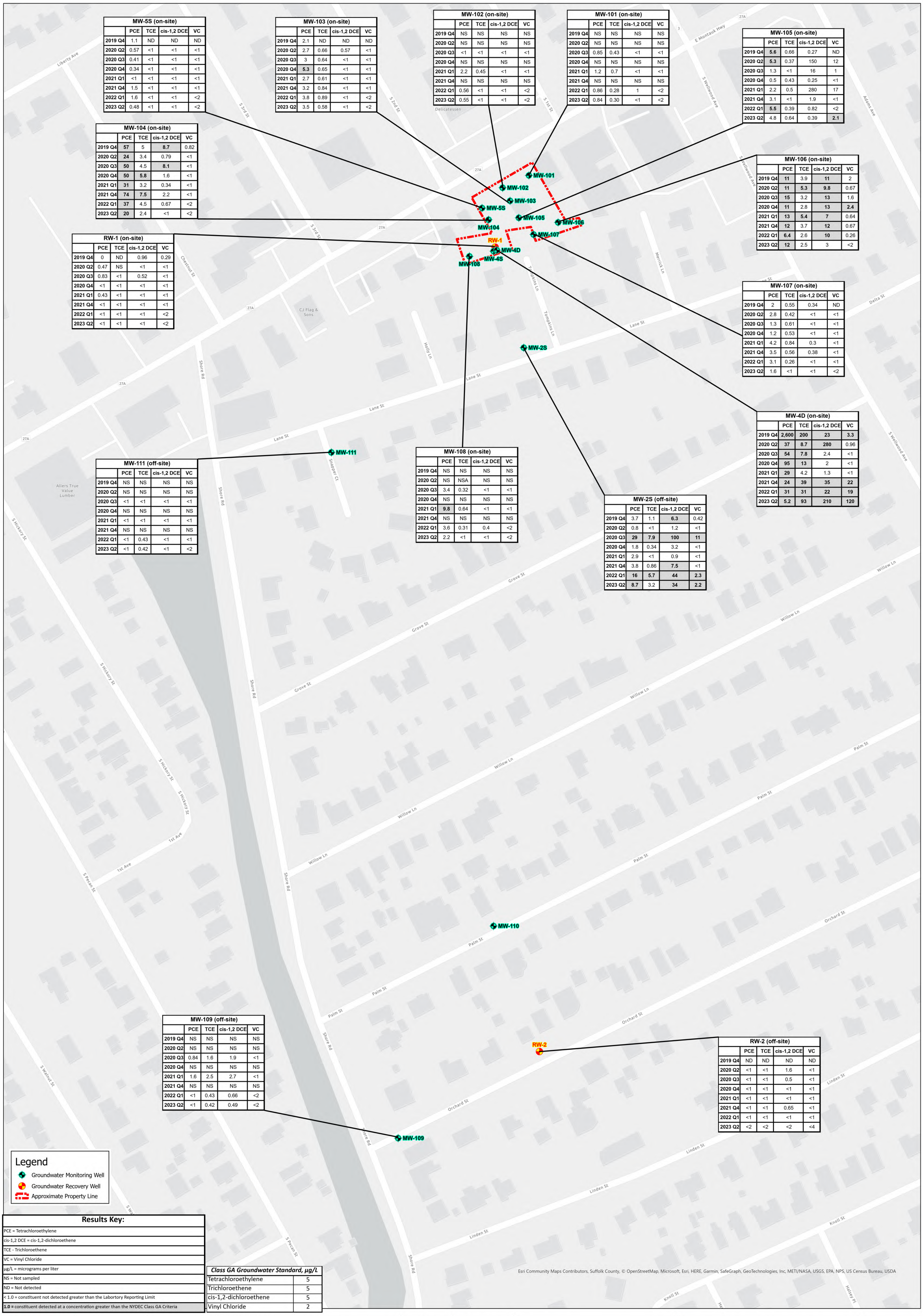
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125

DESIGNED BY: DR	SHEET SIZE: 11X17	North	FIGURE 4
DRAWN BY: BOB	DATE: 08/02/2023	1" = 150'	
REVIEWED BY: DR	PROJECT NUMBER: DEC1004.OM	0 75 150 Ft	

Path: S:\Data\N\NYDEC - NYSDEC\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\GIS\GIS.aprx



Path: S:\Data\N\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\GIS\Figure 4 - Remaining Soil Sample Exceedances.mxd



MW-5S (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	1.1	ND	ND	ND
2020 Q2	0.57	<1	<1	<1
2020 Q3	0.41	<1	<1	<1
2020 Q4	0.34	<1	<1	<1
2021 Q1	<1	<1	<1	<1
2021 Q4	1.5	<1	<1	<1
2022 Q1	1.6	<1	<1	<2
2023 Q2	0.48	<1	<1	<2

MW-103 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	2.1	ND	ND	ND
2020 Q2	2.7	0.66	0.57	<1
2020 Q3	3	0.64	<1	<1
2020 Q4	**5.3**	0.65	<1	<1
2021 Q1	2.7	0.61	<1	<1
2021 Q4	3.2	0.84	<1	<1
2022 Q1	3.8	0.89	<1	<2
2023 Q2	3.5	0.58	<1	<2

MW-102 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	NS	NS	NS	NS
2020 Q2	NS	NS	NS	NS
2020 Q3	<1	<1	<1	<1
2020 Q4	NS	NS	NS	NS
2021 Q1	2.2	0.45	<1	<1
2021 Q4	NS	NS	NS	NS
2022 Q1	0.56	<1	<1	<2
2023 Q2	0.55	<1	<1	<2

MW-101 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	NS	NS	NS	NS
2020 Q2	NS	NS	NS	NS
2020 Q3	0.85	0.43	<1	<1
2020 Q4	NS	NS	NS	NS
2021 Q1	1.2	0.7	<1	<1
2021 Q4	NS	NS	NS	NS
2022 Q1	0.86	0.28	1	<2
2023 Q2	0.84	0.30	<1	<2

MW-105 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	**5.6**	0.66	0.27	ND
2020 Q2	**5.3**	0.37	150	12
2020 Q3	1.3	<1	16	1
2020 Q4	0.5	0.43	0.25	<1
2021 Q1	2.2	0.5	280	17
2021 Q4	3.1	<1	1.9	<1
2022 Q1	**5.5**	0.39	0.82	<2
2023 Q2	4.8	0.64	0.39	**2.1**

MW-104 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	**57**	5	**8.7**	0.82
2020 Q2	**24**	3.4	0.79	<1
2020 Q3	**50**	4.5	**8.1**	<1
2020 Q4	**50**	**5.8**	1.6	<1
2021 Q1	**31**	3.2	0.34	<1
2021 Q4	**74**	**7.5**	2.2	<1
2022 Q1	**37**	4.5	0.67	<2
2023 Q2	**20**	2.4	<1	<2

MW-106 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	**11**	3.9	**11**	2
2020 Q2	**11**	**5.3**	**9.8**	0.67
2020 Q3	**15**	3.2	**13**	1.6
2020 Q4	**11**	2.8	**13**	**2.4**
2021 Q1	**13**	**5.4**	**7**	0.64
2021 Q4	**12**	3.7	**12**	0.67
2022 Q1	**6.4**	2.6	**10**	0.26
2023 Q2	**12**	2.5	3	<2

RW-1 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	0	ND	0.96	0.29
2020 Q2	0.47	NS	<1	<1
2020 Q3	0.83	<1	0.52	<1
2020 Q4	<1	<1	<1	<1
2021 Q1	0.43	<1	<1	<1
2021 Q4	<1	<1	<1	<1
2022 Q1	<1	<1	<1	<2
2023 Q2	<1	<1	<1	<2

MW-107 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	2	0.55	0.34	ND
2020 Q2	2.8	0.42	<1	<1
2020 Q3	1.3	0.61	<1	<1
2020 Q4	1.2	0.53	<1	<1
2021 Q1	4.2	0.84	0.3	<1
2021 Q4	3.5	0.56	0.38	<1
2022 Q1	3.1	0.26	<1	<1
2023 Q2	1.6	<1	<1	<2

MW-4D (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	**2,600**	**200**	**23**	**3.3**
2020 Q2	**37**	**8.7**	**280**	0.96
2020 Q3	**54**	**7.8**	2.4	<1
2020 Q4	**95**	**13**	2	<1
2021 Q1	**29**	4.2	1.3	<1
2021 Q4	**24**	**39**	**35**	**22**
2022 Q1	**31**	**31**	**22**	**19**
2023 Q2	**5.2**	**93**	**210**	**120**

MW-111 (off-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	NS	NS	NS	NS
2020 Q2	NS	NS	NS	NS
2020 Q3	<1	<1	<1	<1
2020 Q4	NS	NS	NS	NS
2021 Q1	<1	<1	<1	<1
2021 Q4	NS	NS	NS	NS
2022 Q1	<1	0.43	<1	<1
2023 Q2	<1	0.42	<1	<2

MW-108 (on-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	NS	NS	NS	NS
2020 Q2	NS	NSA	NS	NS
2020 Q3	3.4	0.32	<1	<1
2020 Q4	NS	NS	NS	NS
2021 Q1	**9.8**	0.64	<1	<1
2021 Q4	NS	NS	NS	NS
2022 Q1	3.6	0.31	0.4	<2
2023 Q2	2.2	<1	<1	<2

MW-2S (off-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	3.7	1.1	**6.3**	0.42
2020 Q2	0.8	<1	1.2	<1
2020 Q3	**29**	**7.9**	**100**	**11**
2020 Q4	1.8	0.34	3.2	<1
2021 Q1	2.9	<1	0.9	<1
2021 Q4	3.8	0.86	**7.5**	<1
2022 Q1	**16**	**5.7**	**44**	**2.3**
2023 Q2	**8.7**	3.2	**34**	**2.2**

MW-109 (off-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	NS	NS	NS	NS
2020 Q2	NS	NS	NS	NS
2020 Q3	0.84	1.6	1.9	<1
2020 Q4	NS	NS	NS	NS
2021 Q1	1.6	2.5	2.7	<1
2021 Q4	NS	NS	NS	NS
2022 Q1	<1	0.43	0.66	<2
2023 Q2	<1	0.42	0.49	<2

RW-2 (off-site)

	PCE	TCE	cis-1,2 DCE	VC
2019 Q4	ND	ND	ND	ND
2020 Q2	<1	<1	1.6	<1
2020 Q3	<1	<1	0.5	<1
2020 Q4	<1	<1	<1	<1
2021 Q1	<1	<1	<1	<1
2021 Q4	<1	<1	0.65	<1
2022 Q1	<1	<1	<1	<1
2023 Q2	<2	<2	<2	<4

Legend

- Groundwater Monitoring Well
- Groundwater Recovery Well
- Approximate Property Line

Results Key:

PCE = Tetrachloroethylene
cis-1,2 DCE = cis-1,2-dichloroethene
TCE - Trichloroethene
VC = Vinyl Chloride
µg/L = micrograms per liter
NS = Not sampled
ND = Not detected
< 1.0 = constituent not detected greater than the Labortory Reporting Limit
1.0 = constituent detected at a concentration greater than the NYDEC Class GA Criteria

Class GA Groundwater Standard, µg/L	
Tetrachloroethylene	5
Trichloroethene	5
cis-1,2-dichloroethene	5
Vinyl Chloride	2

HRP
MOVE YOUR ENVIRONMENT FORWARD
ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM

NORTH

0 40 80 Feet

REVISIONS

NO.	DATE	DESCRIPTION

DESIGNED: DR	SCALE 1"=80'
DRAWN BOB	ISSUE DATE 09/15/2023
REVIEWED DR	PROJECT NUMBER DEC1004.OM
APPROVED MW	SHEET SIZE 24"X36"

63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125

Groundwater Analytical Results (2019-2023)

FIGURE
6

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HRP
MOVE YOUR ENVIRONMENT FORWARD
197 SCOTT SWAMP ROAD
FARMINGTON, CT 06032
(860) 674-9570
HRPASSOCIATES.COM

Legend

- Approximate Property Line
- Structure Sample
- Groundwater Monitoring Well
- Groundwater Recovery Well
- Sub-Slab Depressurization System

0 50 100 FT.

Tetrachloroethylene (PCE)

ID	Sub-Slab	Basement	First Floor
M01	2.8	No Basement	0.37
M02	NS	2.4	0.98
MO3	59	22	70 J
M04	1,100	2.2 J	2 J
M05	81	1.8	5.1
M06	NS	1.9	NS
M07	ND	0.37	ND
M08	NS	0.55 J	0.55 J

J = ESTIMATED VALUE
NS = NOT SAMPLED
ND = NOT DETECTED
RESULTS SHOWN IN $\mu g/m^3$

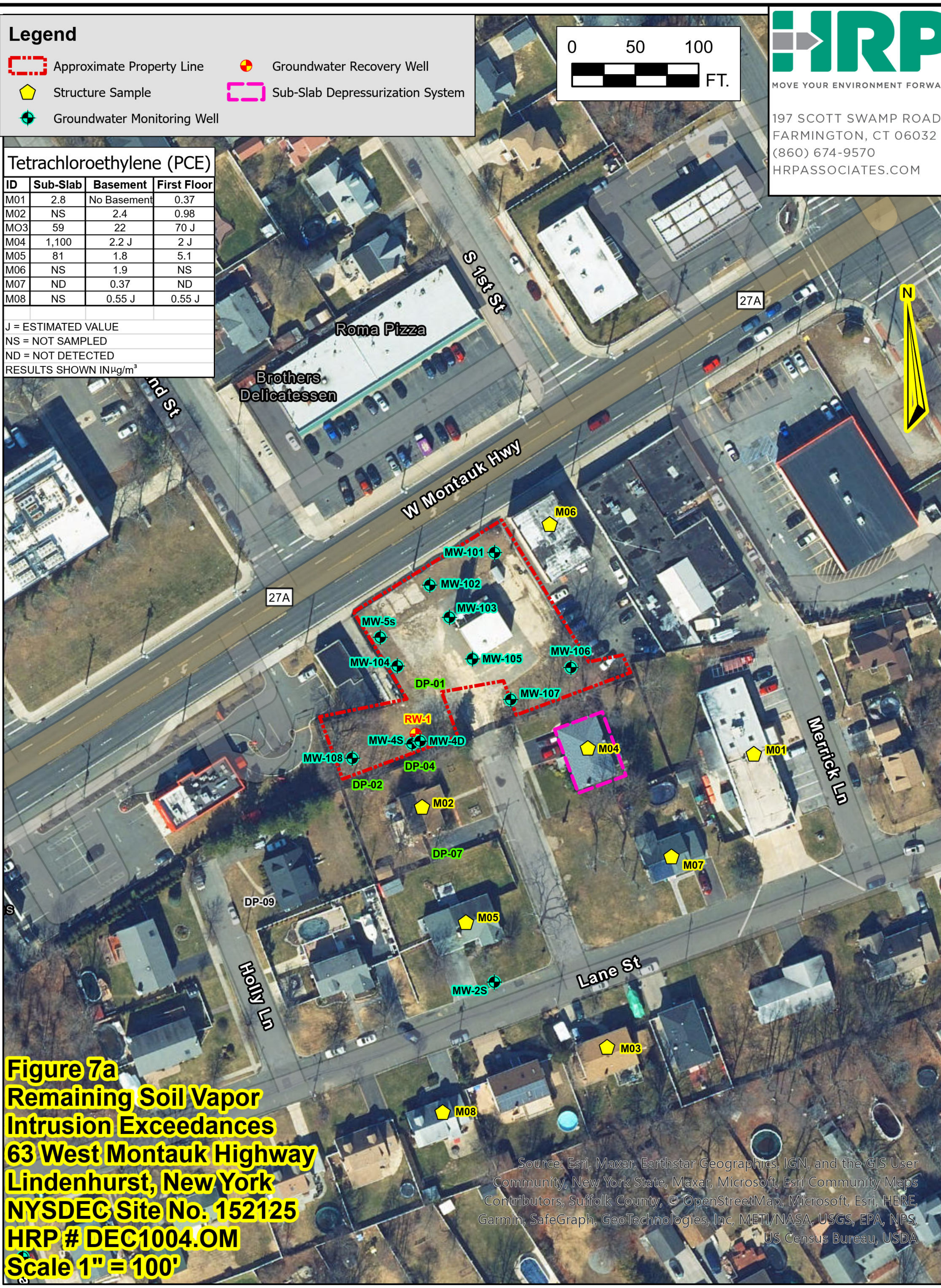

Figure 7a
Remaining Soil Vapor Intrusion Exceedances
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125
HRP # DEC1004.OM
Scale 1" = 100'

Source: Esri, Maxar, Earthstar Geographics, IGN, and the GIS User Community, New York State, Maxar, Microsoft, Esri Community Maps Contributors, Suffolk County, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

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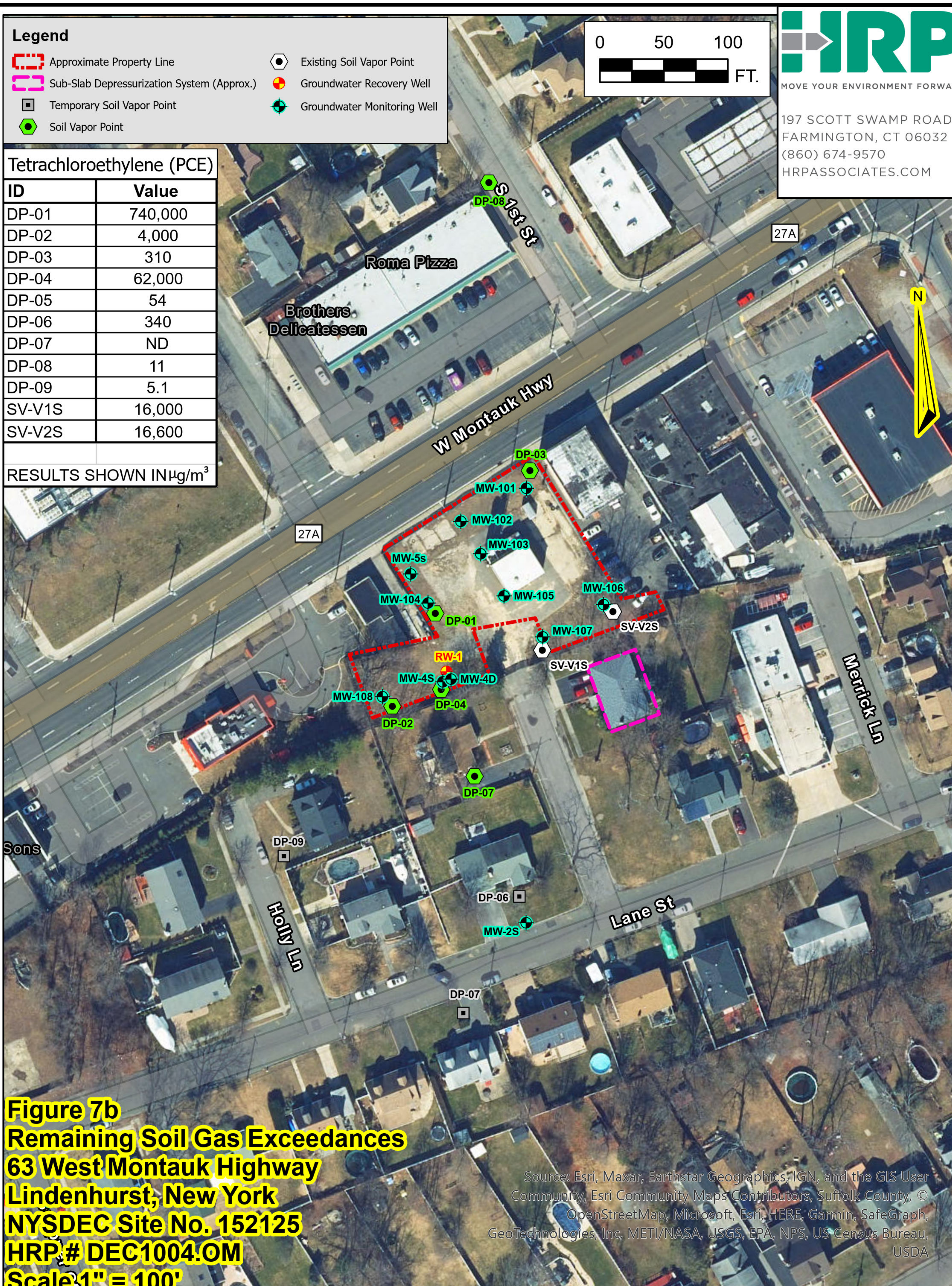
Figure 7b
Remaining Soil Gas Exceedances
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125
HRP # DEC1004.OM
Scale 1" = 100'

MOVE YOUR ENVIRONMENT FORWARD
197 SCOTT SWAMP ROAD
FARMINGTON, CT 06032
(860) 674-9570
HRPASSOCIATES.COM



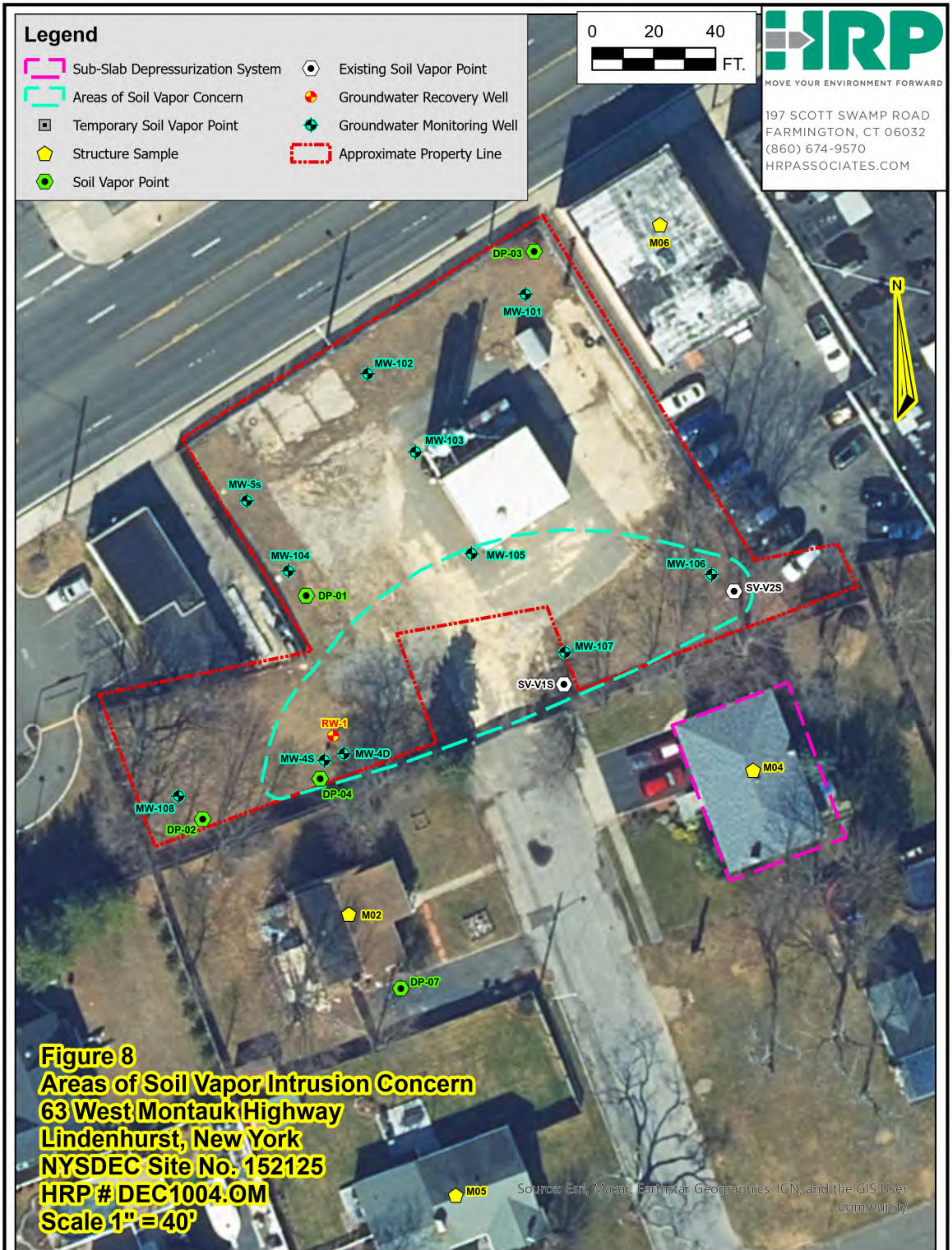
Legend

- Approximate Property Line
- Sub-Slab Depressurization System (Approx.)
- Temporary Soil Vapor Point
- Soil Vapor Point
- Existing Soil Vapor Point
- Groundwater Recovery Well
- Groundwater Monitoring Well

Tetrachloroethylene (PCE)	
ID	**Value**
DP-01	740,000
DP-02	4,000
DP-03	310
DP-04	62,000
DP-05	54
DP-06	340
DP-07	ND
DP-08	11
DP-09	5.1
SV-V1S	16,000
SV-V2S	16,600
RESULTS SHOWN IN $\mu g/m^3$	

Source: Esri, Maxar, Earthstar Geographics, IGN, and the GIS User Community, Esri Community Maps Contributors, Suffolk County, © OpenStreetMap, Microsoft, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Path: S:\Data\NYDEC - NYSDEC\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\GIS\Figs for SMP\Figures\Figures.aprx



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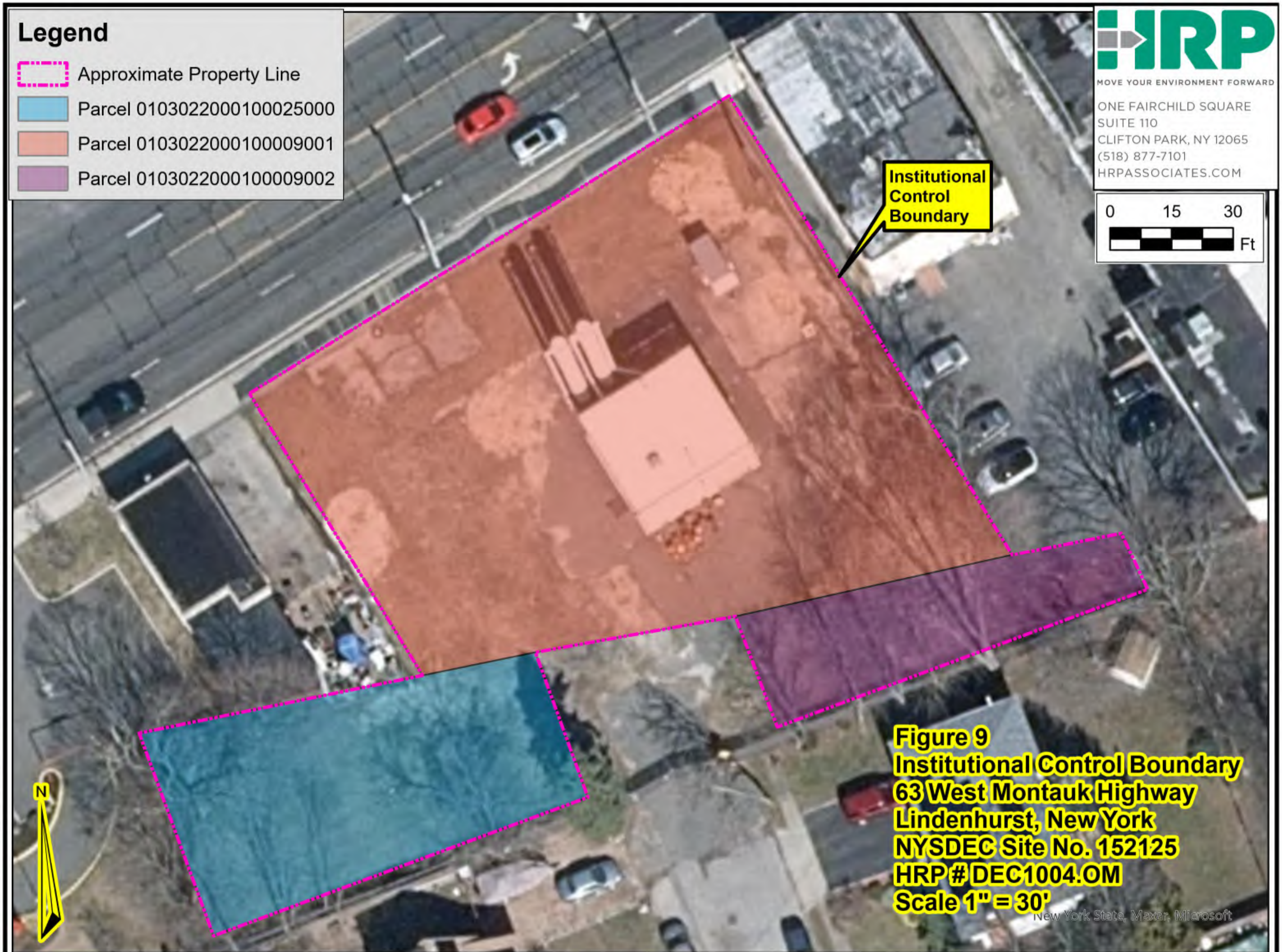

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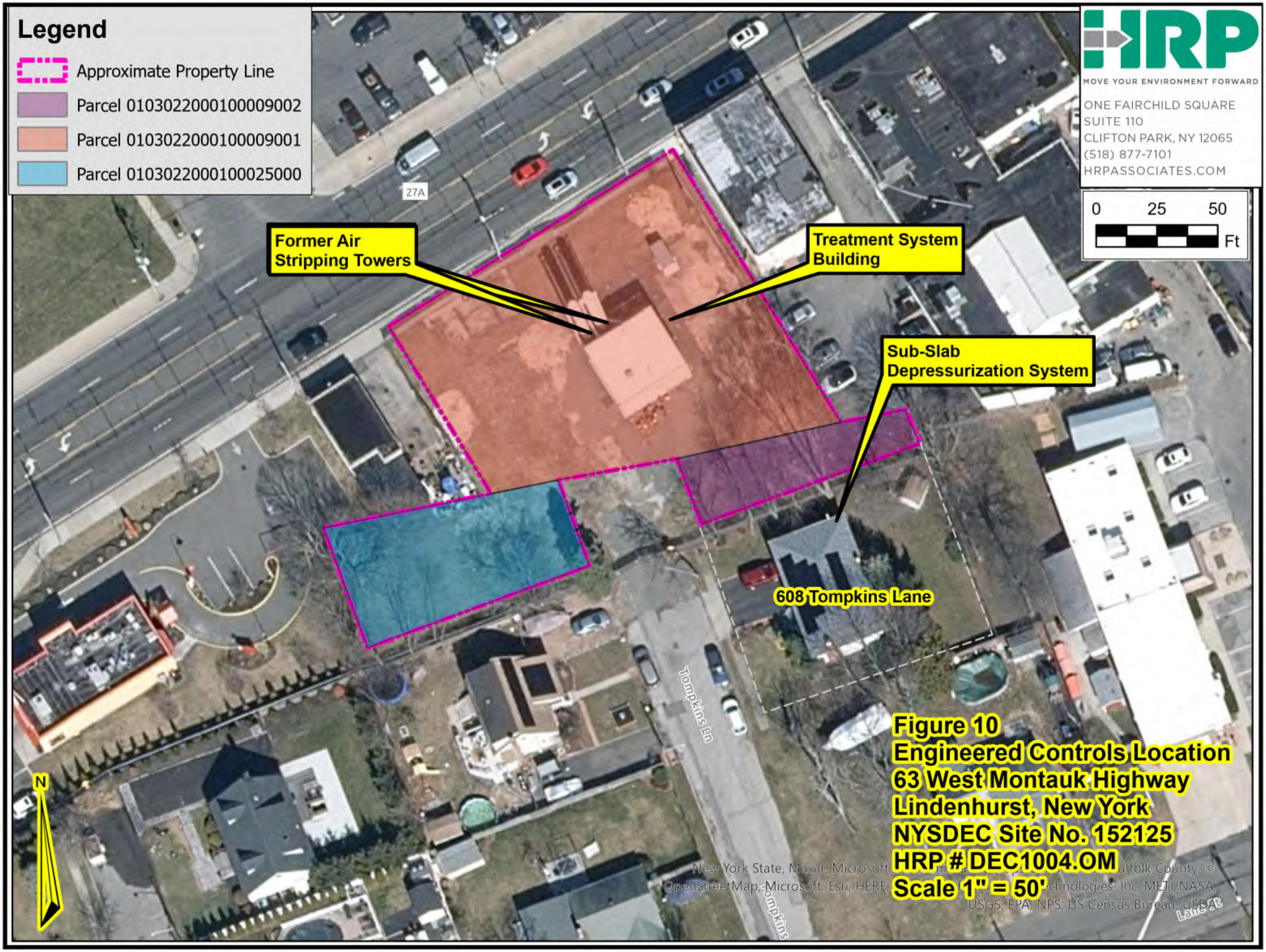

Legend
Approximate Property Line
Parcel 0103022000100009002
Parcel 0103022000100009001
Parcel 0103022000100025000
HRP
MOVE YOUR ENVIRONMENT FORWARD
ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM
0 25 50
Ft
27A
Former Air Stripping Towers
Treatment System Building
Sub-Slab Depressurization System
608 Tompkins Lane
Tompkins Ln
N
Figure 10
Engineered Controls Location
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125
HRP # DEC1004.OM
Scale 1" = 50'

APPENDIX A

Declaration of Covenants and Restrictions

DECLARATION of COVENANTS and RESTRICTIONS

THIS COVENANT is made the 28th day of April 2014, by AmeriPride Services Inc. formerly known as American Linen Supply, a corporation organized and existing under the laws of the State ofDelaware and having an office for the transaction of business at10801 Wayzata Blvd, Minnetonka, MN 55305.

WHEREAS,Active Industrial Uniform Site is the subject of a Settlement Order on Consent (the "Settlement") executed by American Linen Supply Co. and Active Industrial Uniform Co., Inc., as Settling Parties, as part of the New York State Department of Environmental Conservation's (the "Department's") State Superfund Program, namely that parcel of real property located on 63 West Merrick Roadin theVillage ofLindenhurst, County ofSuffolk, State of New York, which is part of lands conveyed byIrving Beckerman and Esther Beckerman to Active Industrial Uniform Co., Inc.by deed datedDecember 4, 1979 and recorded in the SuffolkCounty Clerk's Office in Liber and Page8739 and 101, respectively,and being more particularly described in Appendix "A," attached to this declaration and made a part hereof, and hereinafter referred to as "the Property"; and

WHEREAS, pursuant to the Settlement, the Department implemented a remedial program at the Property, continues to operate and maintain the engineering controls which are part of the remedial program, and continues to maintain certain institutional controls; and

WHEREAS, the Department approved a remedy to eliminate or mitigate all significant threats to the environment presented by the contamination disposed at the Property and such remedy requires that the Property be subject to restrictive covenants.

NOW, THEREFORE,AmeriPride Services Inc., for itself and its successors and/or assigns, covenants that:

First, the Property subject to this Declaration of Covenants and Restrictions is as shown on a map attached to this declaration as Appendix "B" and made a part hereof.

Second, unless prior written approval by the Department or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens, hereinafter referred to as "the Relevant Agency," is first obtained, where contamination remains at the Property subject to the provisions of the Site Management Plan ("SMP"), there shall be no construction, use or occupancy of the Property that results in the disturbance or excavation of the Property which threatens the integrity of the engineering controls or which results in unacceptable human exposure to contaminated soils.

Third, the owner of the Property shall notdisturb, remove, or otherwise interfere with the installation, use, operation, and maintenance of engineering controls required for the Remedy, which are described in the SMP, unless in each instance the owner first obtains a written waiver of such prohibition from the Department or Relevant Agency.

Fourth, the owner of the Property shall prohibit the Property from ever being used for purposes other than for Restricted Residential, Commercial or Industrial usewithout the express written waiver of such prohibition by the Department or Relevant Agency.

Fifth, the owner of the Property shall prohibit the use of the groundwater underlying the Property without treatment rendering it safe for drinking water or industrial purposes, as appropriate, unless the user first obtains permission to do so from the Department or Relevant Agency.

Sixth, the owner of the Property, upon request, shall providea periodic certification, to the Department or Relevant Agency, which will certify that: (i) the institutional controls consisting of land and groundwater use restrictions described above in the Fourth and Fifth paragraphs put in place are unchanged from the previous certification, (ii)that the owner has complied with the provisions of this restrictive covenant, including compliance with Sections 2.5 *Excavation Work* Plan, 2.6 *Soil Vapor*, and 2.7.2 *Notifications* (bullets 4 & 5)of the SMP, (iii) that there has been no change in use of the property, unless the Department has been properly notified, and (iv) that the engineering controls and those institutional controls which are not the responsibility of the owner pursuant to the Settlementhave not been impaired by action of the owner or the owner's contractor, agent, servants, employees, any lessees, or any person using the Property.

Seventh, the owner of the Property shall continue in full force and effect any institutional controls required for the Remedy and maintain/not interfere with such controls, unless the owner first obtains permission to discontinue such controls from the Department or Relevant Agency, in compliance with the approved SMP, which is incorporated and made enforceable hereto, subject to modifications as approved by the Department or Relevant Agency.

Eighth,the owner of the Property shall provide the Department and its contractor access to the Property during the pendency of the operation, maintenance and monitoring of the engineering controls required by the remedial program.

Ninth, this Declaration is and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Property, and shall provide that the owner and its successors and assigns consent to enforcement by the Department or Relevant Agency of the prohibitions and restrictions that the Department or Relevant Agencyrequires to be recorded, and the owner and its successors and assigns hereby covenant not to contest the authority of theDepartment or Relevant Agency to seek enforcement.

Tenth, any deed of conveyance of the Property, or any portion thereof, shall recite, unless the Department or Relevant Agency has consented to the termination of such covenants and restrictions, that said conveyance is subject to this Declaration of Covenants and Restrictions.

IN WITNESS WHEREOF, the undersigned has executed this instrument the day written below.

By: ______________________

Print Name: William Evans

Title: President/CEO Date: 4/28/14

STATE OF MINNESOTA)

) s.s.:

COUNTY OF HENNEPIN)

On the 28th day of April, in the year 2014, before me, the undersigned, personally appeared William Evans, personally known to me or proved to me on the basis of satisfactory evidence to be the individual whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his capacity, and that by his signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

DOROTHY J. JOHNSON
NOTARY PUBLIC - MINNESOTA
My Commission Expires
January 31, 2019

____
Notary Public State of Minnesota

APPENDIX "A"

ALL that certain plot, piece or parcel of land, with the buildings and improvements thereonerected, situate, lying and being in the Incorporated Village or Lindenhurst, in the Town of Babylon, County of Suffolk and State of New York, being Lots 19-24, inclusive, and Lot 24A in Block 18, as shown on the "Amended Map No. 2. of South Bay Estates," and filed in the Office of the Clerk of the County of Suffolk on 8/17/1921, as Map No. 282; and Lots 64-66, inclusive, as shown on "Map of Village Center Park," as filed 8/24/1926 in the Office of the Clerk of the County or Suffolk as Map No. 816; and a portion of the two foot reserve strip as shown on the latter map, which said lots and reserve strip when taken together, are bounded and described as follows:

BEGINNING at a point on the southerly side of Montauk Highway, distant 329.18 feet westerly from the corner formed by the intersection of the southerly side of Montauk Highway with the westerly side of Wellwood Avenue, as widened;

RUNNING thence South 18 degrees 02 minutes East, 134.92 feet to the northerly side of the two (2') foot reserve strip onMap of Village Center Park;

THENCE South 86 degrees 58 minutes 50 seconds East along said, 30.58.feet;

THENCE South 6 degrees 17 minutes 50 secondsEast, 14.96 feet;

THENCE South 83 degrees 42 minutes 10 seconds West, 100.00 feet to the easterly side of Tompkins Lane;

THENCENorth 6 degrees 17 minutes 50 seconds West along said easterlyside of Tompkins Lane, 29.35 feet to the southerly side of said reserve strip;

THENCENorth 86degrees 58 minutes 50 seconds West along said strip 50.67 feet to the westerly side of Tompkins Lane;

THENCE South 6 degrees 17 minutes 50 secondsEast, along the westerly side of Tompkins Lane 37.56 feet;

THENCESouth 83 degrees 42 minutes 10 secondsWest, 100.00 feet;

THENCE North 16 degrees 17 minutes 50 seconds West, 53.97 feet to the southerly side of said reserve strip;

THENCESouth 86 degrees 58 minutes 50 seconds East along said reserve strip 73.18 feet;

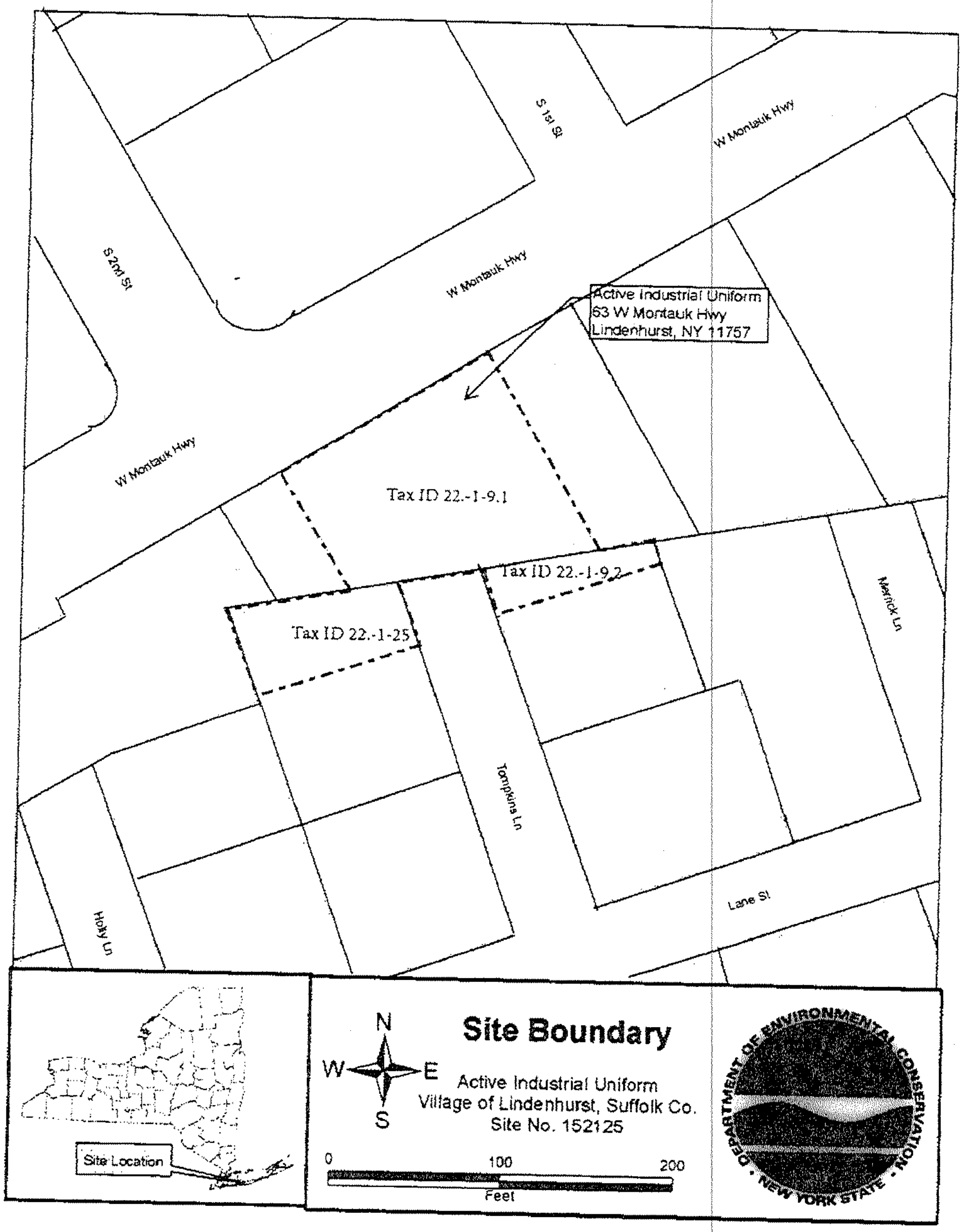
THENCE North 18 degrees 02 minutes West, 83.17 feet to the southerly side ofMontaukHighway; and

THENCE North 71 degrees 58 minutes East along the southerly side of MontaukHighway, 140.00 feet to the point or place of BEGINNING.

Subject to telephone agreement recorded in Liber 1078 cp 318.

Subject to any state of facts an accurate survey may reveal.

APPENDIX "B"



[12/10]

HP LaserJet P2015 Series PCL 5
RECORDING0017[illegible]

RECEIPT

Suffolk County Clerk

JUDITH A. PASCALE

County Clerk

Receipt Number : 14-0066068
Payor Name : FRONTIER ABSTRACT

DESCRIPTION	TRANS AMOUNT
Type of Instrument: DECLARATION	
Page/Filing	$30.00
Handling	$20.00
COE	$5.00
NYS SRCHG	$15.00
TP-584	$0.00
Notation	$0.00
Cert.Copies	$5.20
RPT	$180.00
Fees Paid	$255.20
LIBER	D00012774
PAGE	796

DATE: 05/20/2014 TIME: 03:55:08 PM

RECEIPT TOTAL	$255.20
CHECK AMT PAID	$255.20
TOTAL AMOUNT PAID	$255.20
CHECK REFUND	$0.00

COMMENTS

CC #: C14-21867

COUNTY CLERK'S OFFICE

STATE OF NEW YORK

COUNTY OF SUFFOLK

I, JUDITH A. PASCALE, Clerk of the County of Suffolk and the Court of Record thereof do hereby certify that I have compared the annexed with the original **DECLARATION**
recorded in my office on **05/20/2014** under Liber **D00012774** and Page **796** and, that the same is a true copy thereof, and of the whole of such original.

In Testimony Whereof, I have hereunto set my hand and affixed the seal of said County and Court this **05/20/2014** .

SUFFOLK COUNTY CLERK

Judith A. Pascale

JUDITH A. PASCALE

SEAL

[redacted]

SUFFOLK COUNTY CLERK
RECORDS OFFICE
RECORDING PAGE

Type of Instrument: DECLARATION
Number of Pages: 6
Receipt Number : 14-0066068

Recorded: 05/20/2014
At: 03:55:08 PM

LIBER: D00012774
PAGE: 796

District:	Section:	Block:	Lot:
0103	022.00	01.00	009.001

EXAMINED AND CHARGED AS FOLLOWS

Received the Following Fees For Above Instrument

		Exempt			Exempt
Page/Filing	$30.00	NO	Handling	$20.00	NO
COE	$5.00	NO	NYS SRCHG	$15.00	NO
TP-584	$0.00	NO	Notation	$0.00	NO
Cert.Copies	$5.20	NO	RPT	$180.00	NO
			Fees Paid	$255.20	

THIS PAGE IS A PART OF THE INSTRUMENT
THIS IS NOT A BILL

JUDITH A. PASCALE
County Clerk, Suffolk County

1 | 2

Number of pages 6

This document will be public record. Please remove all Social Security Numbers prior to recording.

RECORDED
2014 May 20 03:55:38 PM
JUDITH A. PASCALE
CLERK OF
SUFFOLK COUNTY
L 000012774
P 796

Deed / Mortgage Instrument | Deed / Mortgage Tax Stamp | Recording / Filing Stamps

3 FEES

Page / Filing Fee	30		Mortgage Amt.	
Handling	20. 00		1. Basic Tax	
TP-584			2. Additional Tax	
Notation			Sub Total	
EA-52 17 (County)		Sub Total 50	Spec./Assit. or Spec. /Add.	
EA-5217 (State)			TOT. MTG. TAX	
R.P.T.S.A.	180		Dual Town ___ Dual County ___ Held for Appointment ___	
Comm. of Ed.	5. 00		Transfer Tax	
Affidavit			Mansion Tax	
Certified Copy	5 20			
NYS Surcharge	15. 00	Sub Total 205 20		
Other		Grand Total 255 20		

The property covered by this mortgage is or will be improved by a one or two family dwelling only.
YES ________ or NO ________

If NO, see appropriate tax clause on page # ________ of this instrument.

4 Dist. 0100 2727776 See Attached 001

Real Property Tax Service Agency Verification

P T S
R CWH A
16-MAY-14

5 Community Preservation Fund

Consideration Amount $ ________

CPF Tax Due $ ________

Improved ________

Vacant Land ______

TD ________

TD ________

TD ________

6 Satisfactions/Discharges/Releases List Property Owners Mailing Address
RECORD & RETURN TO:

Frontier Abstract
30 W. Broad St. Suite 100
Rochester, NY
14614

Mail to: Judith A. Pascale, Suffolk County Clerk
310 Center Drive, Riverhead, NY 11901
www.suffolkcountyny.gov/clerk

7 Title Company Information

Co. Name Frontier Abstract

Title # FRO-14-56,7211

8 # Suffolk County Recording & Endorsement Page

This page forms part of the attached Declaration of Covenants and Restrictions made by:
(SPECIFY TYPE OF INSTRUMENT)

AmeriPride Services, Inc.

The premises herein is situated in SUFFOLK COUNTY, NEW YORK.

TO

New York State Department of Environmental Conservation

In the TOWN of Babylon.
In the VILLAGE
or HAMLET of ________

BOXES 6 THRU 8 MUST BE TYPED OR PRINTED IN BLACK INK ONLY PRIOR TO RECORDING OR FILING.

(over)

Stat ID: 2727776

PTS
R CWH A
16-MAY-14

$180

Tax Maps

District	Secton	Block	Lot	School District
0103	02200	0100	009001	
0103	02200	0100	009002	
0103	02200	0100	025000	

APPENDIX B

List of Site Contacts

List of Site Contacts

Name	Phone/Email Address
Site Owner: AmeriPride Services, Inc. Randy Cook (Environmental Manager)	(612) 676-8060 Randy.Cook@ameripride.com
NYSDEC Project Manager: Jasmine Stefansky	(518) 402-9575 jasmine.stefansky@dec.ny.gov
Jeffrey Dyber: NYSDEC Project Managers Supervisor	(518) 402-9621 jeffrey.dyber@dec.ny.gov
NYSDEC Region 1 HW Engineer: Chris Engelhardt RHWRE	(631) 444-0235 Chris.engelhardt@dec.ny.gov
NYSDEC Site Control: Kelly Lewandowski	(518) 402-9553 Kelly.lewandowski@dec.ny.gov
Sally Rushford: NYSDOH Project Manager	(518) 402-5465 Sally.Rushford@health.ny.gov
Qualified Environmental Professional: Joshua R. Oliver, PG	(315) 679-4856 joliver@eaeast.com

APPENDIX C
EWP

EXCAVATION WORK PLAN

ACTIVE INDUSTRIAL UNIFORM
Suffolk County
Lindenhurst, New York
NYSDEC Site Number: 152125

Prepared For:
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233

Prepared By:

HRP Associates, Inc.
197 Scott Swamp Road
Farmington, CT 06032

HRP #: DEC1004.OM

Issued On: March 30, 2021

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 General

This Excavation Work Plan (EWP) is a required element of the Site Management Plan (SMP) for the Active Industrial Uniform facility located at 63 West Merrick Road (a.k.a. West Montauk Highway, or State Route 27A) in the Village of Lindenhurst, Suffolk County, New York (hereinafter referred to as the "Site"). The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program Site No. 152125, which is administered by New York State Department of Environmental Conservation (NYSDEC).

The Site is currently vacant. Historically, the Site was occupied by a dry cleaner and laundry. The laundering operations were performed at the Site between 1945 and 1993; dry cleaning operations were conducted between 1970 and 1987. In June 1993, the laundering operation ceased, and the facility began operating as a distribution center. In May 1994, all operations of the Site had ceased. In February 1995, the on-site buildings were demolished.

An initial soil and groundwater investigation of the Site was conducted in 1987. A release of chlorinated solvents was identified at the Site associated with the storage and use of dry cleaning chemicals. Volatile organic compounds (VOCs) were detected in soil and groundwater samples. Three former tetrachloroethylene (PCE) storage tanks were identified as the source of contamination. In 1991, a soil vapor extraction (SVE) was installed at the Site. Active Industrial Uniform entered into an Order of Consent on September 22, 1993 with the NYSDEC to remediate the Site. In March 1997, a Record of Decision (ROD) was issued by the NYSDEC, which outlined the remedial approach for the Site. Remedial activities at the Site included excavation of the polluted soil, underground storage tanks and drywells; operation of soil vapor extraction (SVE) system (constructed in 1991 and dismantled in 2000); operation of the Groundwater Extraction & Treatment (GWE&T) remedial system; and installation of a sub-slab depressurization (SSD) system off-site at 608 Tompkins Lane. The GWE&T system, constructed at the Site in 2001, was shut off in 2018 per NYSDEC direction. The air stripping towers were decommissioned in late 2020 and removed from the Site in March 2021.

1.2 Purpose

As discussed above, impacted soils have been identified at the Site and remedial excavations have been conducted. An additional soil investigation was conducted in 2019 and included test pit installations. While a report for this work had not been prepared at the time, it was indicated that no significant source of contamination was identified during test pit activities. It is understood that certain soil impacts exceeding the cleanup criteria continue to be present in the vicinity of monitoring well MW-4D. This excavation work plan (EWP) was developed to be followed during any potential future excavation activities in order to protect human health and the environmental during excavation work and ensure that applicable regulations and guidance are followed.

There are currently no planned excavation activities for the Site. However, if future activities require excavation of soils, then a task-specific EWP should be prepared. Intrusive activities have the potential to expose site workers and/or the public to remaining groundwater and/or soil contamination. Any future excavation work should be conducted in accordance with an EWP.

Additionally, a Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP) should be prepared by the excavation Contractor in accordance with DER-10, Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910, OSHA 29 CFR 1926, and all other applicable Federal, State, and local regulations. The EWP should be submitted to the NYSDEC for review and approval prior to conducting any excavation work.

S:\Data\N\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\WP\152125-EWP.docx

2.0 PRELIMINARY ACTIVITIES

2.1 Notification

The excavating Contractor shall submit a task-specific EWP to the NYSDEC for review and approval at least 15 days prior to the start of any intrusive activity, in which remaining contamination may be encountered. The task-specific EWP shall include the following:

- A detailed description of the work to be performed, including the location and areal extent of the proposed excavation;
- Plans for Site re-grading, estimated volumes of contaminated soil to be excavated and any work that may impact the Site engineering control (EC), such as the GWE&T system or associated extraction and monitoring wells;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive activities;
- A statement that the work will be performed in compliance with this EWP and OSHA 29 CFR 1910.120;
- A copy of the Contractor's HASP and CAMP;
- Identification of disposal facilities for potential waste streams;
- Identification of sources for any imported backfill soils, along with any required laboratory analytical results.

2.2 Utility Clearance

Prior to implementing any intrusive activities, utility clearance procedures shall be conducted. The procedures include utility markouts required by law through the Code 753, obtaining and reviewing available Site utility drawings, and a field reconnaissance to verify, to the extent possible, the location of utilities relative to the planned locations of all intrusive activities.

The Code 753 utility markout shall be completed as per the 16 New York Codes, Rules and Regulations (NYCRR) Part 753. Consistent with the One-Call (also called Dig Safe New York) criteria, a request will be made by the excavation contractor at least 72 hours prior to initiating fieldwork. Confirmations that the utilities have been marked out, as per Code 753 requirements, shall be documented in the project file. All hard-copy confirmations will also be available in the field during all intrusive operations. If the utility markings become faint or obscure they will be refreshed as needed.

In addition, a private utility markout contractor shall also be utilized to survey proposed excavation areas for buried utilities or other subsurface features.

3.0 SOIL REMOVAL AND MANAGEMENT

Site excavation activities include the construction processes associated with the physical removal of contaminated soil and sediment. These processes include excavation of contaminated soil and sediment, transportation and disposal of contaminated soil, backfill, and restoration of the excavated area.

3.1 Excavation

At a minimum, the following requirements apply to excavations within the areas of remaining contamination at the Site. Methods for compliance with these requirements shall be addressed in the Contractor's task-specific EWP:

- A qualified environmental professional (QEP) or person under their supervision shall oversee all intrusive activities and "loadout" of any excavated material;
- Excavated materials shall be transported to a designated staging area such that they may be tested and properly managed;
- Excavated materials shall be staged on polyethylene sheeting to prevent contact with undisturbed soils;
- Stockpiles shall be secured each day by covering with polyethylene sheeting and employing methods to contain any sediment (such as surrounding with hay bales); and
- Excavation shall be performed in a manner that will prevent spills and the possibility for potentially contaminated soil to be mixed with uncontaminated material.

3.2 Soil Stockpiling

At a minimum, the following requirements apply to the storage of materials excavated from areas where remaining contamination has been identified at the Site. Methods for compliance with these requirements shall be addressed in the Contractor's task-specific EWP:

- Excavated material shall be placed in temporary storage;
- Soil stockpiles shall be encircled with a berm and/or silt fence. Hay bales shall be used, as needed, near catch basins and other discharge points;
- Stockpiles shall be kept covered at all times with appropriately anchored tarps;
- Stockpiles shall be routinely inspected, and damaged tarp covers will be promptly replaced;
- In the unlikely event that soil must be stockpiled for extended lengths of time, stockpiles shall be inspected at a minimum of once per week and after every storm event. Results of inspections shall be recorded in a logbook and made available for inspection by the NYSDEC;
- Roll-off or equivalent units used to store any contaminated material shall be watertight;
- Storage and handling of contaminated soil shall be performed in accordance with all applicable NYSDEC regulations.

3.3 Contaminated Soil Transportation and Disposal

Contaminated soil and sediment shall be transported to and be disposed at a licensed facility in accordance with state and federal regulations.

The following requirements apply to the transportation and disposal of excavated contaminated material from the Site. Methods for compliance with these requirements shall be addressed in the Contractor's task-specific EWP:

- Sampling, classifying, manifesting, labeling, transporting, and disposal of waste shall be performed in accordance with all applicable federal, state, and local laws and regulations;
- Materials removed from the Site shall be transported directly to the disposal facility;
- All transport of materials shall be performed by licensed transporters in accordance with applicable local, State, and Federal regulations, including 6 NYCRR;
- Loaded vehicles leaving the Site shall be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and New York State Department of Transportation (NYSDOT) requirements (and all other applicable transportation requirements);
- Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-site soil tracking;
- Waste characterization sampling frequency, analysis methods, and analytical laboratory shall be approved by the NYSDEC prior to removal of any material from the Site;
- Letters of commitment shall be obtained from all disposal facilities to be used during the project. The letters shall state that the disposal facility is permitted to accept all Site waste and has the available capacity to receive the waste;
- All vehicles shall be decontaminated prior to leaving the Site, if necessary.

3.4 Excavation Backfill

The following requirements apply to the fill material proposed to be used to restore the Site after excavation activities have been completed. Methods for compliance with these requirements shall be addressed in the Contractor's task-specific EWP:

- Fill material proposed to be used to restore the Site shall be similar in physical properties to the material removed. Fill used for building foundations or other construction is exempt from this requirement;
- The fill material shall be of equal or less permeability than the native soil in or adjacent to the excavated area;
- All fill material to be utilized at the Site shall meet the requirements of 6 NYCRR Part 375 Unrestricted Use criteria, at a minimum;
- Documentation of the quality of the fill shall be provided by a certification stating that it is virgin material from a commercial or noncommercial source;
- If documentation of the quality of the fill material cannot be provided, a backfill evaluation proposal, which identifies material characterization protocols, shall be submitted to and approved by the NYSDEC prior to the use of any fill material.

3.5 Fluids Management

Based on the depth to groundwater beneath the Site (approximately 6 to 10 feet measured during the most recent, January 2021, groundwater sampling event), it is possible that groundwater may be encountered if future excavations exceeding these depths are completed at the Site. Based on contaminant concentrations in on-site groundwater, any purge water generated from any future dewatering activities will be collected on-site for subsequent settling and sampling prior to disposal. If necessary, methods for compliance with these requirements shall be addressed in the Contractor's task-specific EWP.

3.6 Excavation Restoration

After the completion of soil removal and any other intrusive activities, all Site cover material shall be restored to pre-excavation conditions, or per the requirements of the NYSDEC.

3.7 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are encountered during any excavation activities, such activities shall be suspended until sufficient equipment is mobilized to the Site to properly address these conditions. Sampling of all identified below-grade structures and contaminated soils, etc. shall be completed by the excavating Contractor, as necessary, to determine the nature of the material and develop proper disposal methods. Chemical analysis shall be performed for a full list of analytes (target analyte list [TAL] metals, target compound list [TCL] volatile and semi- volatile organic compounds, TCL pesticides, and polychlorinated biphenyls [PCBs]), unless the Site history and previous sampling results provide a sufficient justification to limit this list of analytes. In this case, a reduced list of analytes shall be proposed to the NYSDEC for approval prior to sampling. Identification of unknown or unexpected contaminated media identified by screening during intrusive activities shall be promptly communicated to the NYSDEC's Project Manager. Reportable quantities of product will also be reported to the NYSDEC spills hotline.

3.8 Community Air Monitoring Plan

The excavating Contractor will be responsible for preparing a CAMP, which shall be included in the task-specific EWP. Guidance can be obtained in Appendix 1A (Generic Community Air Monitoring Plan) of DER-10. At a minimum, the CAMP shall include the following:

- Details of the perimeter air monitoring program;
- Action levels to be used;
- Analytes measured and instrumentation to be used;
- A map of the location(s) of all air monitoring instrumentation. A map showing specific locations must be presented for monitoring stations based on generally prevailing wind conditions, with a note that the exact locations to be monitored on a given day will be established based on the daily wind direction.

Exceedances of action levels listed in the CAMP shall be reported to the NYSDEC Project Manager.

3.9 Odor Control Plan

The excavating Contractor shall be responsible for preparing an Odor Control Plan (OCP), as part of the task-specific EWP. This OCP shall be capable of controlling emissions of nuisance odors to off-site locations. If nuisance odors are identified at the Site boundary, or if odor complaints are received, work shall be halted and the source of odors shall be identified and corrected. Work will not resume until all nuisance odors have been abated. The NYSDEC shall be notified of all odor complaint events. Implementation of all odor controls, including the halting of any work, is the responsibility of the Contractor.

All necessary means shall be employed to prevent on and off-site odor nuisances. At a minimum, these measures shall include the following:

- Limiting the area of open excavations and size of soil stockpiles;
- Shrouding soil piles and open excavations with tarps and other covers; and
- Using foams to cover exposed odorous soils.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances shall include:

- Direct load-out of soils to trucks for off-site disposal;
- Use of chemical deodorants in spray or misting systems; and
- Use of staff to monitor odors in surrounding neighborhoods.

If nuisance odors develop during intrusive activities 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 shall be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

3.10 Dust Control Plan

A Dust Control Plan that addresses dust management during intrusive activities will be addressed in the Contractor's task-specific EWP, and shall include, at a minimum, the following:

- The Site cover/maintained lawn removal shall be completed in stages to limit the area of exposed soils, vulnerable to dust production;
- Dust suppression shall initially be achieved through use of the existing hose located on the south side of the treatment system building. If this is ineffective, the Contractor shall utilize a dedicated on-site water truck for dust suppression;
- The truck shall be equipped with a water cannon capable of spraying water directly onto open excavations and onto soil stockpiles;
- Gravel shall be used on roadways to provide a clean and dust-free road surface, if necessary.

APPENDIX D
Soil Boring and Monitoring Well Logs

LAWGIBB GROUP

SITE NAME
SITE LOCATION

Sample/Core Log

Boring/Well MW-101 Project/No. 22000-0-0019 Page 1 of 4

Site Location Active Ind. Lindenhurst, NY Drilling Started 6/5/01 Drilling Completed 6/5/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/Coring Device split spoon

Length and Diameter of Coring Device 2 Foot x 2 inches Sampling Interval 5 feet centers

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used — Drilling Method HSA

Drilling Contractor Summit Drilling Driller MATT Helper BRIAN

Prepared By Scott Horsnall Hammer Weight 140 Hammer Drop 30 ins.

Background PID ϕ ppm
START 1200

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			Sand-fill-2'
				Brown sand (m)
5.0	7.0	1.1	5.7.8.10	0.0-0.3 Brown sand (m)
				0.3-0.7 Gray brown silt - little clay
				0.7-1.1 orange brown sand (m), little gravel moist
				PID ϕ ppm
5.0	10.0			Orange-brown sand (m) some gravel (f-m) rounded qtz ϕ ppm
10.0	12.0	2.0	1.2.2.2	0.0-0.7 Gray sand (m) some gravel fine qtz
			ϕ ppm	
				0.7-1.1 Brown-TAN sand (m)
			1 ppm	1.1-1.4 Black stained sand (m-c) sl. petro odor
				1.4-2.0 Sand TAN-brown (m-c) no odor

[illegible] 3-8 ppm max

ϕ ppm

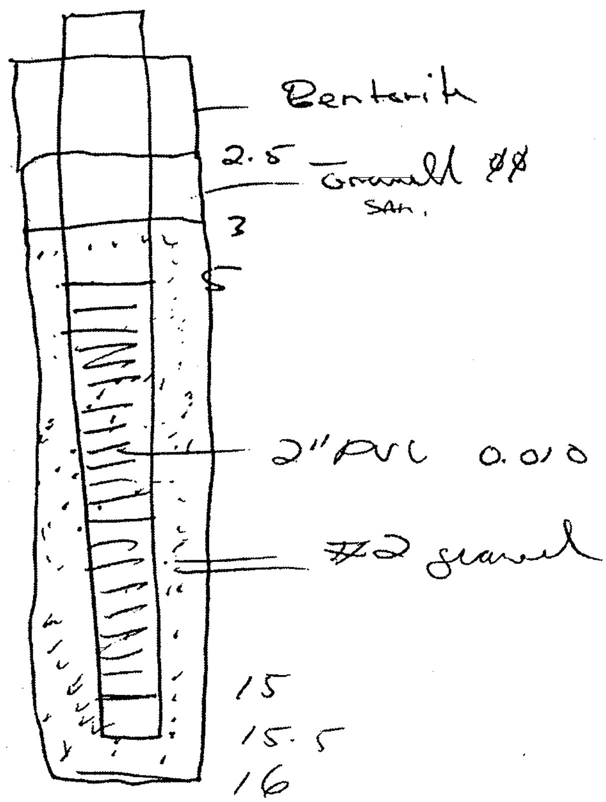
MW-101

8" BoreHole

5 Bags Sand

Bentonite

ØØ SAND



LAWGIBB GROUP

SITE NAME
SITE LOCATION

Sample/Core Log

Boring/Well MW-102 Project/No. 22000-0-001 Page 1 of 1

Site Location Active Ind. Lindenhurst, NY Drilling Started 6/5/01 Drilling Completed 6/5/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/Coring Device Split Spoon

Length and Diameter of Coring Device 2 Foot x 2 Inches Sampling Interval 5' feet CENTERS

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used ____ Drilling Method HSA

Drilling Contractor Summit Drilling Driller MATT Helper BRIAN

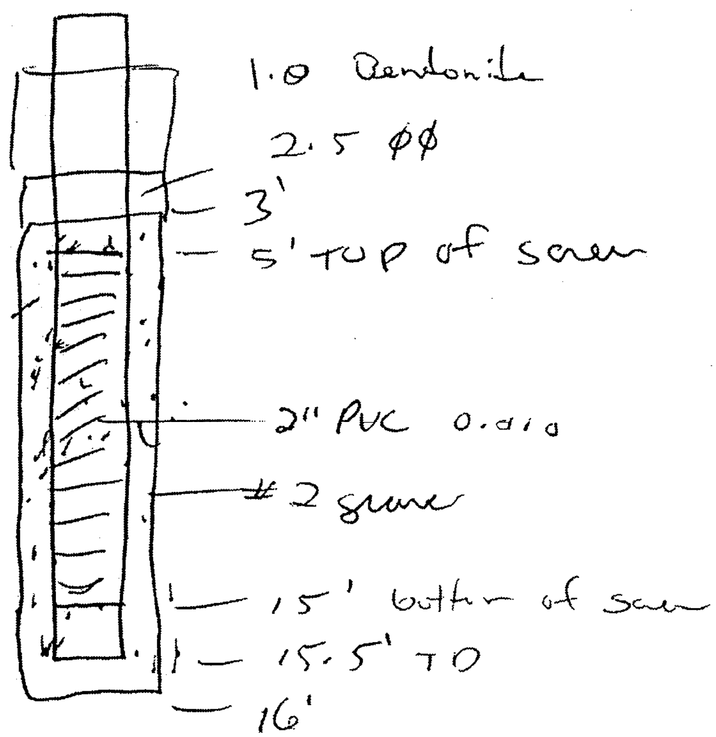
Prepared By Scott Harsnall Hammer Weight 140 Hammer Drop 30 ins.

Background PID ϕ ppm
START 1010

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			Fill material brown-gray fine sand, silt
				gravel - grading to brown sand (m)
5.0	7.0	1.5	3-4-6-7	0.0-0.6 brown sand (m)
				Trace gravel (f)
				0.6-1.0 Orange-brown sand (m)
				1.0-1.5 Tan-sand (m) little coarse
				little gravel (f) qtz subrounded
				ϕ ppm moist
8.0	10.0			Tan - sand (m) grading to
				Tan brown sand (m-c) little gravel (f)
10.0	12.0	2.0	5-5-5-6	Sand Tan-Brown (m-c) w/ some
				gravel (f-m) qtz subrounded
				wet (SATURATED) - PID ϕ ppm
10.0	15.0			Sand Tan-brown (m-c) some gravel
				(f-m) qtz subrounded
				ϕ ppm

MW-102

8" Borehole



Bags of Gravel

1/2 BAG ΦΦ

LAWGIBB GROUP

SITE NAME
SITE LOCATION

Sample/Core Log

Boring/Well MW-103 Project/No. 22000-0-0019 Page 1 of 1

Site Location Active Ind. Lindenhurst NY Drilling Started 6/5/01 Drilling Completed 6/5/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/ Coring Device Split Spoon

Length and Diameter of Coring Device 2 Foot x 2 inches Sampling Interval 5 feet Centers

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used ——— Drilling Method HSA

Drilling Contractor Summit Drilling Driller MATT Helper BRIAN

Prepared By Scott Horsnall Hammer Weight 140 Hammer Drop 30 ins.

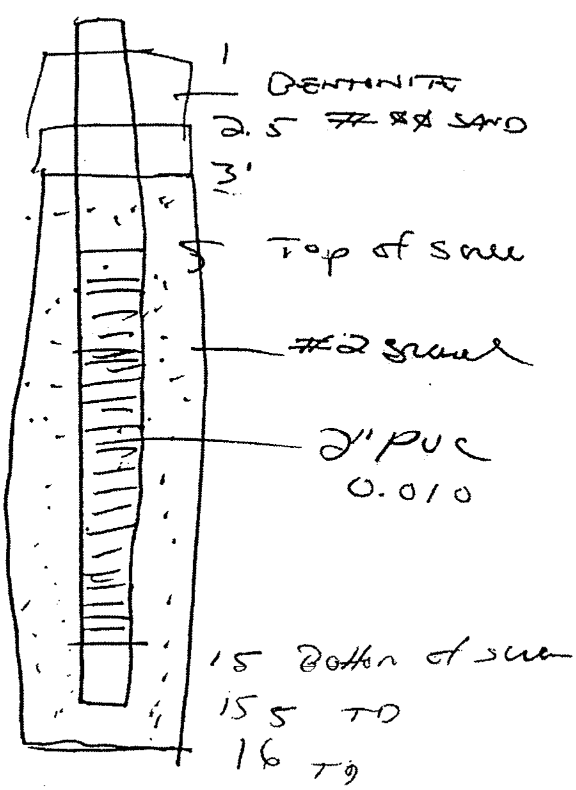
Background PID 0 ppm
START 1315

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			Fill material - dark brown sand (f) and silt with rock, gravel, brick concrete
5.0	7.0	1.1	12 10 2 10	0.0-0.3 - (Fill) dark brown silt + sand fine 0.3-1.1 Sand - orange brown, trace gravel (f) s. rounded qtz 0-1 ppm
5	10			Sand - orange brown sand (m-c) little gravel (f-c)
10.0	12.0	1.4	5 4 3 3	Sand (m-c) gray-black, some gravel (f-m) s. rounded qtz gravel PID 2-3 ppm sl. odor/Petro-solvent Place in zip lock baggie 1-3 ppm
10.0	12.0			As above - Grades to gray brown sand - m-c with gravel (f-m)

Samplelg xls

MW-103
8" Borehole

5 Bags of sand



LAWGIBB GROUP

Sample/Core Log

SITE NAME
SITE LOCATION

Boring/Well MW-104 Project/No. 22000-0-0019 Page 1 of 1

Site Location Active Ind. Lindenhurst, NY Drilling Started 6/5/01 Drilling Completed 6/5/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/Coring Device Split Spoon

Length and Diameter of Coring Device 2 Foot X 2 Inches Sampling Interval 5 feet Centers

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used — Drilling Method HSA

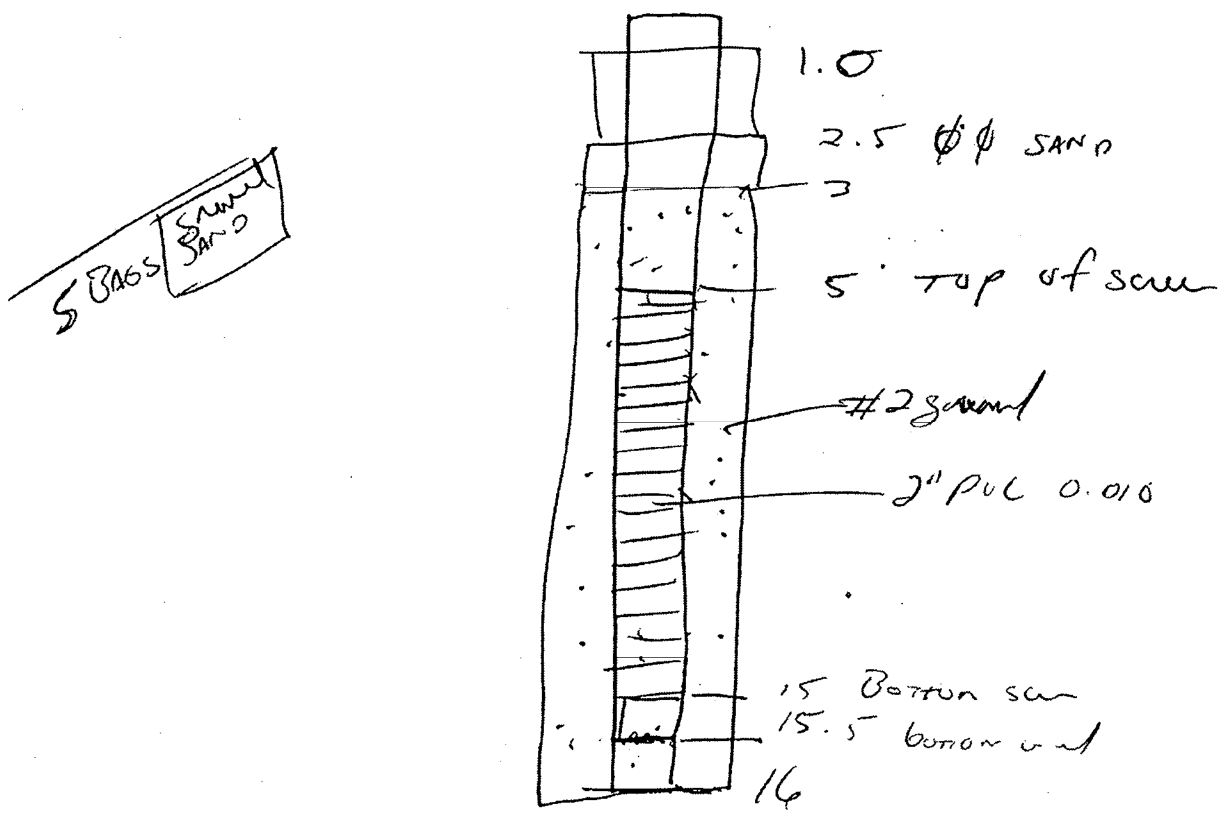
Drilling Contractor Summit Drilling Co. Driller MATT Helper Brian

Prepared By Scott Hornall Hammer Weight 140 Hammer Drop 30 ins.

Background PID 0 ppm
START 0915

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			0.5 Concrete
				Dark brown sand (f) little silt + clay
				trace (f) gravel
5.0	7.0	1.3	8·9·17·20	0.0 - 1.0 Tan sand (m) little gravel (f-m)
				sub-rounded qtz
				1.0 - 1.3 Orange-Tan Sand (m) some
				gravel (f-m) sub rounded moist-wet
				PID 0-2 ppm
5.0	10.0			Orange/Brown-Tan sand (m-c) little
				gravel (f-m) s. rounded qtz
10.0	12.0	1.6	4·6·6·6	Tan-Brown sand (m-c) some-little
				gravel (f-m) s. rounded qtz
				0-1 ppm - PID - Wet-saturated
10.0	15.0			Tan-Brown sand (m-c) some
				gravel (f-c) s. rounded qtz

MW-104



1.0
2.5 ØØ SAND
3
5' TOP of screen
#2 sand
2" PVC 0.010
15 Bottom scr
15.5 bottom end
16
5 BAGS
SAND

LAWGIBB GROUP

Sample/Core Log

SITE NAME
SITE LOCATION

Boring/Well: MW-105 Project/No.: 22000-0-0019 Page 1 of 1

Site Location: Active Ind. Lindenhurst, NY Drilling Started: 6/5/01 Drilling Completed: 6/5/01

Total Depth Drilled: 16 Feet Hole Diameter: 8 inches Type of Sample/Coring Device: Split Spoon

Length and Diameter of Coring Device: 2 FOOT X 2 INCHES Sampling Interval: 5' feet CENTERS

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used: —— Drilling Method: HSA

Drilling Contractor: Summit Drilling Driller: MATT Helper: BRIAN

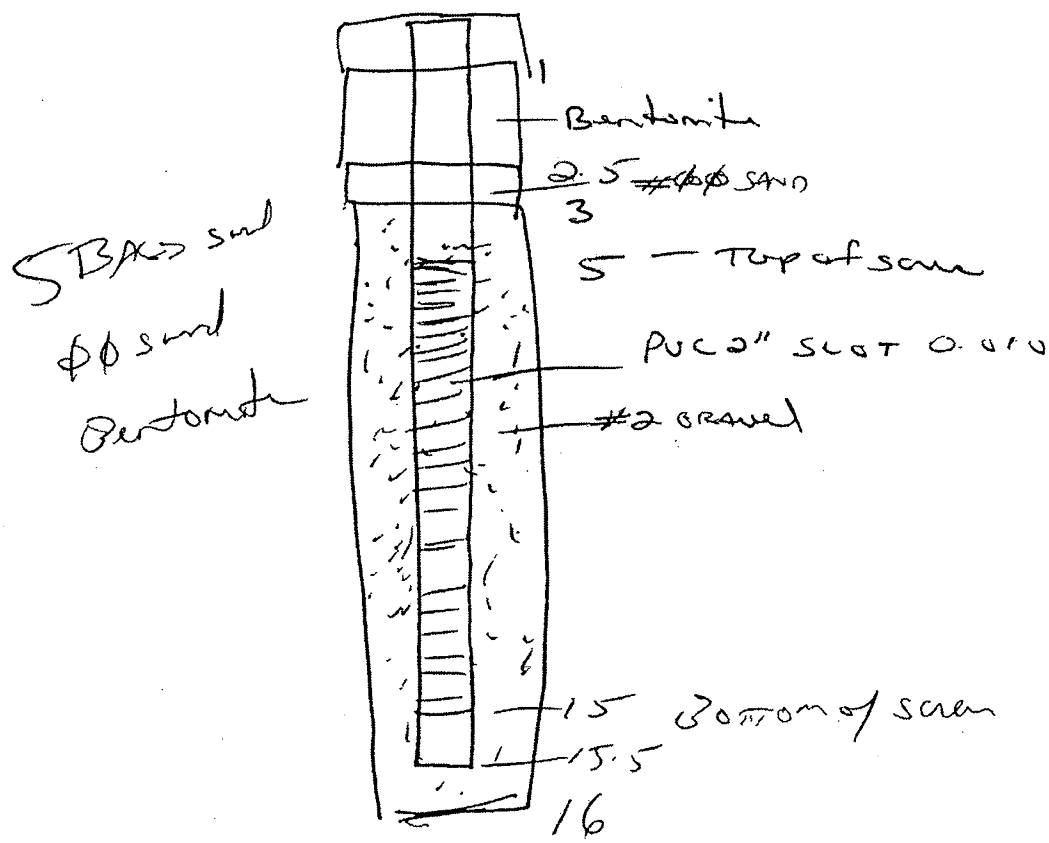
Prepared By: Scott Horsnall Hammer Weight: 140 Hammer Drop: 30 ins

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			(Fill material) Brown-Gray Sand (m) and silt with gravel, brick, concrete
5.0	7.0	1.5	10.12.12.9	0.0-0.7 Same as above 0.7-1.5 Yellow orange sand (m) moist, little gravel (f-m) qtz PID 0-0.5 ppm
5.0	10.0			Yellow brown sand grades to Tan-brown @ 7-8' bgs
10.0	12.0	2.0	8.10.10.10	0.-2 TAN-Brown Sand (m) grades to SAND (c) with gravel (f-c) rounded qtz 0 ppm WET/SATURATED
10	15.0			Same as above

Samplelg xls

MW-105

8" Borehole



LAWGIBB GROUP

SITE NAME
SITE LOCATION

Sample/Core Log

Boring/Well MW-106 Project/No. 22000-0-0019 Page 1 of 1

Site Location Active Ind. Uniform, Lindenhurst NY Drilling Started 6/5/01 Drilling Completed 6/5/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/Coring Device Splitspoon

Length and Diameter of Coring Device 2 FOOT x 2 Inches Sampling Interval 5' feet CENTERS

Land-Surface Elev. — feet ☐ Surveyed ☐ Estimated Datum —

Drilling Fluid Used Drilling Method HSA

Drilling Contractor Summit Drilling Driller MATT Helper BRIAN

Prepared By Scott Horsnall Hammer Weight 140 Hammer Drop 30 ins.

Background PID ф ppm
START 0730

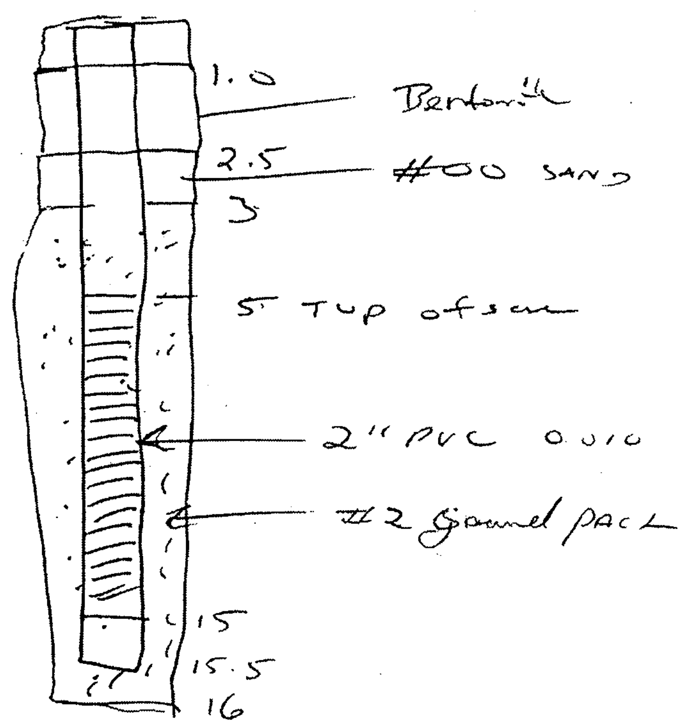
Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			Fill material - Gray-brown SAND (m)
				with SILT - angular gravel
5.0	7.0	1.2	10.6.7.16	0.0-0.5 Same as above
				0.5-1.1 yellow-orange m-c sand
				with gravel (f-c) s. rounded qtz
				PID ф ppm - (MOIST)
5.0	10.0			yellow-orange sand (m-c) little silt
				with gravel (f-c) s. rounded qtz
				ф ppm
10.0	12.0	1.6	6.5.4.4	Brown-TAN sand (m-c) little fine
				with gravel (f-c) s. rounded qtz
				0.5-1.2 Black staining 1ppm 12ppm
				Petro/Diesel odor - Place in bag
				1.2-1.6 Clean - SAND - NO STAINING
10.0	16.0			Brown-TAN sand (m-c) with gravel
				(f-c) subrounded qtz

Samplein.xls

MW-106

SAND/Gravel

5 Bags



LAWGIBB GROUP

Sample/Core Log

SITE NAME
SITE LOCATION

Boring/Well MW-107 Project/No. 22000-0-0019 Page 1 of 1

Site Location Active Ind, Lindenhurst NY Drilling Started 6/4/01 Drilling Completed 6/4/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/ Coring Device Split Spoon

Length and Diameter of Coring Device 2 Foot x 2 Inches Sampling Interval 5' feet centers

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum —

Drilling Fluid Used —— Drilling Method HSA

Drilling Contractor Summit Drilling Driller MATT Helper Brian

Prepared By Scott Horsnall Hammer Weight 140 Hammer Drop 30 ins

Background PID Ø ppm
START 1430

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			Fill material Gray-Brown silt & sand
				(m-f) with gravel + brick
5.0	7.0	1.1	8.7.7.10	0.0-0.5 same as above
				0.5-1.1 yellow brown sand (m)
				some gravel (f) s. rounded
				qtz. (moist) Ø ppm
8				Yellow-brown sand (m) little (c)
				with gravel (f-m) qtz s. rounded
				Grading to a brown 8-10' bgs
10.0	12.0	1.2	1.4.5.4	Sand (m-c) gravel (f-c) sub round qtz
				brown-Gray
				SATURATED - musty/salt odor
				Øppm - 2ppm MAX
10.0	16.0			Same as above

10-15 Grab sample place in baggie 5.5ppm

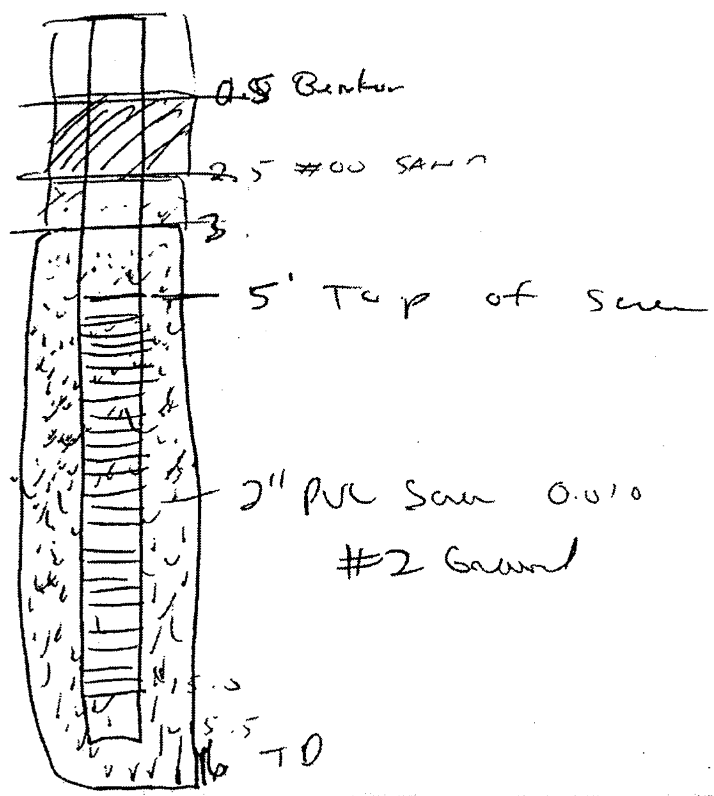
DTW ~ 8' During Drilling

Pull Auger Bottom Auger grey black stain ... with gravel (f-m) Petroleum

Sampleln.xls

MW-107

8" Borehole



5 BAGS Gravel

LAWGIBB GROUP

,ample/Core Log

SITE NAME
SITE LOCATION

Boring/Well MW-108 Project/No. 22000-0-0019 Page 1 of 1

Site Location Active Ind. Drilling Started 6/4/01 Drilling Completed 6/4/01

Total Depth Drilled 16 Feet Hole Diameter 8 inches Type of Sample/ Coring Device Split Spoon

Length and Diameter of Coring Device 2 Foot x 2 Inches Sampling Interval 5' feet centers

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used —— Drilling Method HSA

Drilling Contractor Summit Drilling Driller ~~Steve~~ Matt Helper Brian

Prepared By Scott Horsnall Hammer Weight ____ Hammer Drop 30 ins.

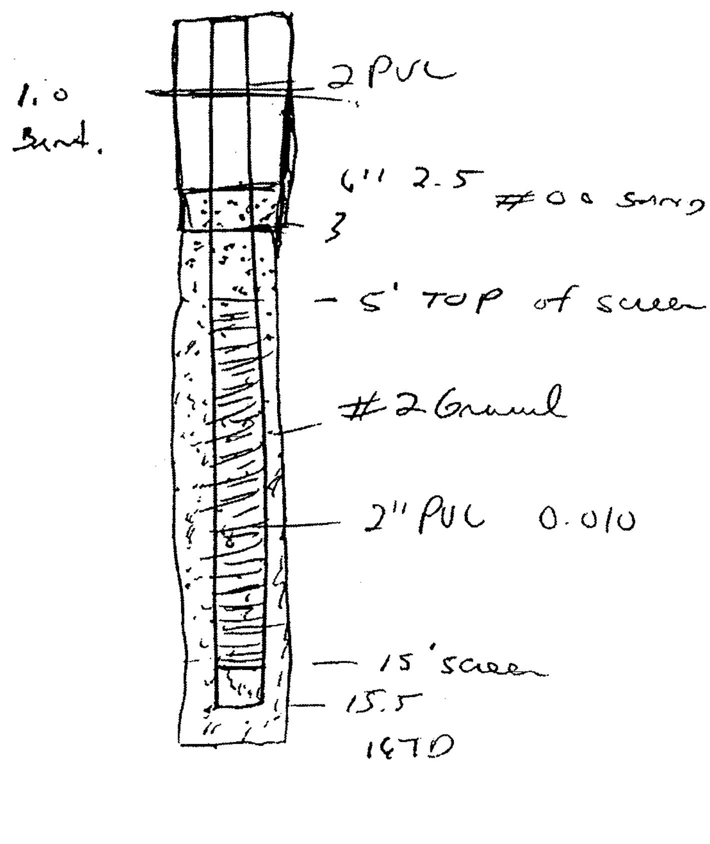
Background PID ppm / START

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	5.0			Brown SAND (f) with (m) some silt & clay
				Gray appears wet 3-4' bgs
5.0	7.0	1.6	17-5-9-13	0.0 - 0.8 Brown-gray Sand (F) with (m)
				some silt & clay
				0.8 - 1.2 Tan, sand (m) little
				angular qtz gravel
				1.2 - 1.4 Yellow-orange Sand (m-c)
				little gravel (f) subrounded
				∅ ppm
				SAND Yellow-orange (m-c) little gravel
				(f) subrounded
10.5	12.5	1.4	7-3-6-6	0.0-1.1 yellow-orange Sand (m-c) some gravel
				(f-m) qtz subrounded. wet
				1.1-1.4 lt brown sand (m) little silt
				Drill to 16' SAND as above
				∅ ppm

NDTW 8' 1310/Drilling / ∅ PID ppm

MW-108

6" Bore hole



5 BAGS Gravel

LAWGIBB GROUP

Sample/Core Log (Cont.d)

Boring/Well: MW-109

Page 1 of 1

Prepared by: Scott Horsnah DTW 2'6ss

6/12/01

SURGE well @ 1105

TIME	pH	cond	Temp	TURB	RATE	Appearance
1030	5.77	23.1	17.1	999	3 gpm	Turbid / cloudy
1035	6.27	23.6	15.5	139	3 gpm	Sl. Turbid
1040	6.33	24.3	15.2	120	2 gpm	cloudy
1045	6.33	24.2	16.0	20	3 gpm	Sl. cloudy
1050					5 gpm	SURGE well
1055					5 gpm	SURGE well
1100	6.44	21.8	15.3	147	5 gpm	Sl. cloudy
1105	6.30	21.9	15.4	0	5 gpm	clear
1110	6.27	21.7	15.1	20	~~SURGE well~~	~~clear~~ 1115 clear
1115	6.30	22.0	15.2	0	5 gpm	clear
1120	6.33	21.6	15.0	0	5 gpm	clear

60 gal

150

210 gallons removed

LAWGIBB GROUP

SITE NAME

SITE LOCATION

ample/Core Log

Boring/Well MW-110 Project/No. 22000-0-0019 Page 1 of 2

Site Location Active Ind., Lindenhurst, NY Drilling Started 4/12/01 Drilling Completed 4/12/01

Total Depth Drilled 36 Feet Hole Diameter 8 inches Type of Sample/Coring Device Split Spoon

Length and Diameter of Coring Device 2 Foot x 2 inches Sampling Interval 5 feet CENTERS

Land-Surface Elev ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used ——— Drilling Method HSA

Drilling Contractor Summit Drilling Driller MATT Helper BRIAN

Prepared By Scott Horsnall Hammer Weight 140 Hammer Drop 30 ins.

Background PID 0 ppm
START 0800

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	0.5			Asphalt
				Sand, brown (m-f) some-little gravel (f
5.0	7.0	1.5	10.11.12.10	ORANGE-TAN Sand (f-c) with gravel
				(f-m) s.rounded qtz
				0 ppm - PID
				SAND & GRAVEL
10.0	12.0	1.4	8.7.6.6	Sand (f-c) Tan-orange and Gravel
				(f-m) qtz - few small cobbles
				1/2"-3/4" 0 ppm
				SAND & GRAVEL
				TAN
15.0	17.0	1.3	6.6.6.6	Sand (f-c) with gravel (F)
				qtz 0 ppm
				SAND & Gravel
20.0	22.0	1.2	5.8.9.11	TAN SAND (f-c) and Gravel (f) s.rounded qtz
				PID 0 ppm

▽ 3-4'

LAWGIBB GROUP

Sample/Core Log (Cont.d)

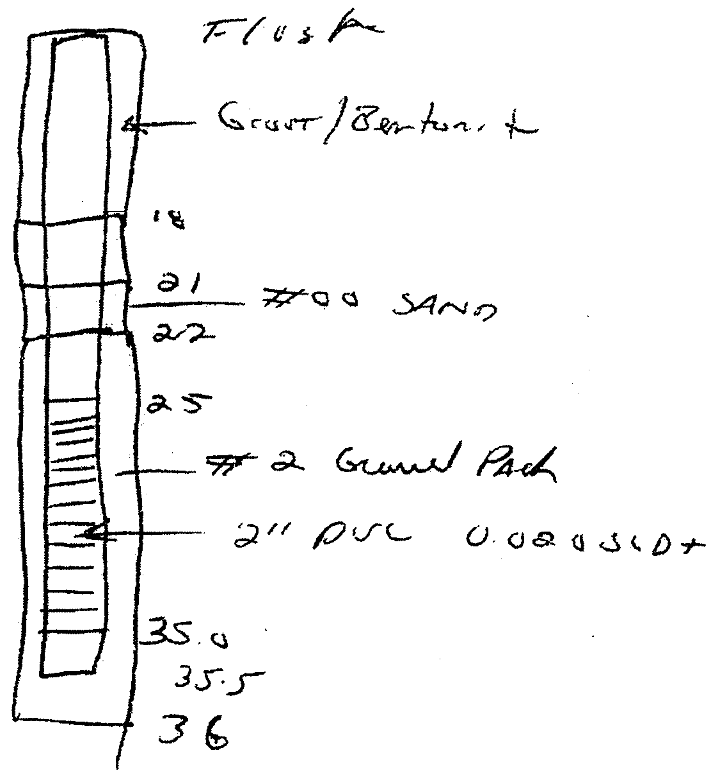
Boring/Well MW-110

Prepared by Scott Hornall

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description
25.0	27.0		4-5-5-6	Tan, Sand (f-m) little coarse sand
				Drill down to 36' - sand
				coming up in augers will
				drill down and set well
25	36			Tan Sand (f-c) with some
				gravel (f-m) rounded qtz

MW-110

8" Bore Hole



LAWGIBB GROUP

Sample/Core Log

SITE NAME
SITE LOCATION

Boring/Well: MW-111 Project/No.: 22000-0-0019 Page 1 of 2

Site Location: Active Ind. Drilling Started: 6/12/01 Drilling Completed: 6/12/01

Total Depth Drilled: 36 Feet Hole Diameter: 8 inches Type of Sample/Coring Device: split spoon

Length and Diameter of Coring Device: 2 Foot x 2 Inches. Sampling Interval: 5' feet CENTERS

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used ____ Drilling Method: HSA

Drilling Contractor: Summit Drilling Driller: MATT Helper: BRIAN

Prepared By: Scott Horswell Hammer Weight: 140 Hammer Drop: 30 ins.

Background PID ∅ ppm

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 inches	Sample/Core Description START 1235
2.0	4.0			Med-brown-brown, sand (f) with silt
4.0				Gray-brown sand (f) moist, some
				clay ∅ silt
				0.0-0.2 Green-brown silty sand laminated
5.0	7.0	1.2		ORANGE Brown - sand (m) wet
				with silt ∅ ppm
				Drill to 10' Sand (m) orange
				brown wet.
10.0	12.0	1.0		ORANGE Brown SAND (f-m) with
				gravel (f-m) s. rounded qtz
				Drill to 15 ∅ ppm
				S.A.A. to 15
15.0	17.0	0.5		TAN SAND (m-c) and Gravel (f-c)
				qtz - few small cobbles 1"
				Drill to 20' SAND ∅ Gravel

LAWGIBB GROUP

Sample/Core Log (Cont.d)

Boring/Well MW-111

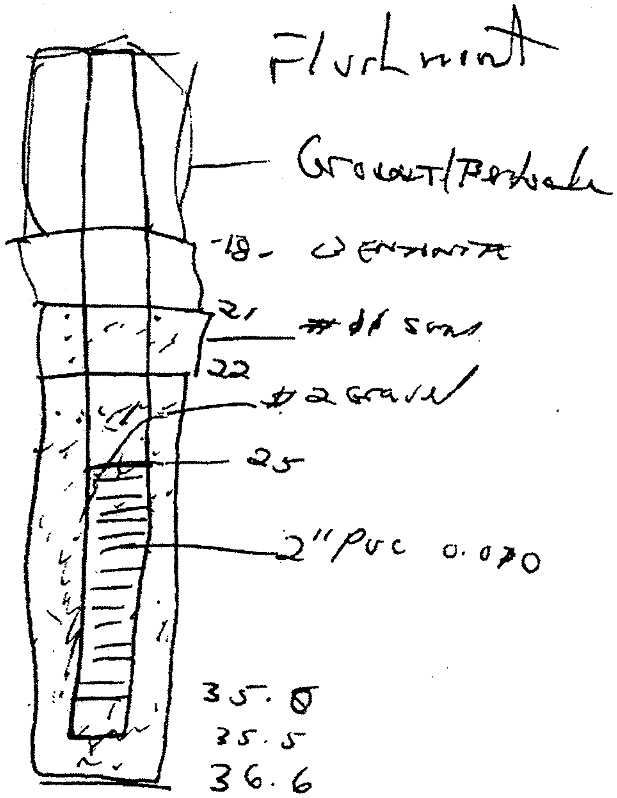
Page 2 of 2

Prepared by Scott Hansen

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
				~~Re~~
20.0	22.0	0.8		Gravel (f-c) s. round qtz, angular feldspar
				~~grav~~ with SAND (c) TAN
				Drill to 25'
25.0	27.0	0.4		Sand (m-f) TAN with some gravel (f)
				?
25.0	36.0			TAN SAND (m-c) and gravel (f-c) s. round
				qtz, feldspar, angular rock fragment

MW-111

8" borehole



LAWGIBB GROUP

SITE NAME
SITE LOCATION

Sample/Core Log

Boring/Well RW-1 Project/No. 22000-0-0019 Page 1 of ___

Site Location Active Ind. Lindenhurst, NY Drilling Started 6/6/01 Drilling Completed 6/6/01

Total Depth Drilled 43 Feet Hole Diameter 8 inches Type of Sample/Coring Device cuttings

Length and Diameter of Coring Device — Sampling Interval 5 feet

Land-Surface Elev. ___ feet ☐ Surveyed ☐ Estimated Datum ___

Drilling Fluid Used Mud Drilling Method HSA 10'/Mud Rotary

Drilling Contractor Summit Drilling Driller MATT Helper Brian/Dave

Prepared By ___ Hammer Weight — Hammer Drop — ins.

0-10 Hollow stem Auger
10-43 12" mud Rotary

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	6.0			Brown sand (f-m) some silt & clay
6.0	10.0			yellow-orange/brown sand (m)
				with gravel (f) s. rounded qtz
				Temp casing to 10'
10	20			Yellow-orange brown sand (m) - Tan-brown
				with gravel (f-m)
				@ 16 gravelly layer
20.0	28.0			Tan-brown sand (m-c) and
				gravel (f-c) qtz, feldspar
				rock frag
				20-28 gravelly
28.0	43.0			Tan-brown sand (m-c) with some
				coarse sand with ~~some~~
				gravel (f-m) - a few
				gravelly layers noted

20-28 Gravelly

was 6 mu
28 0.2/0
the ab

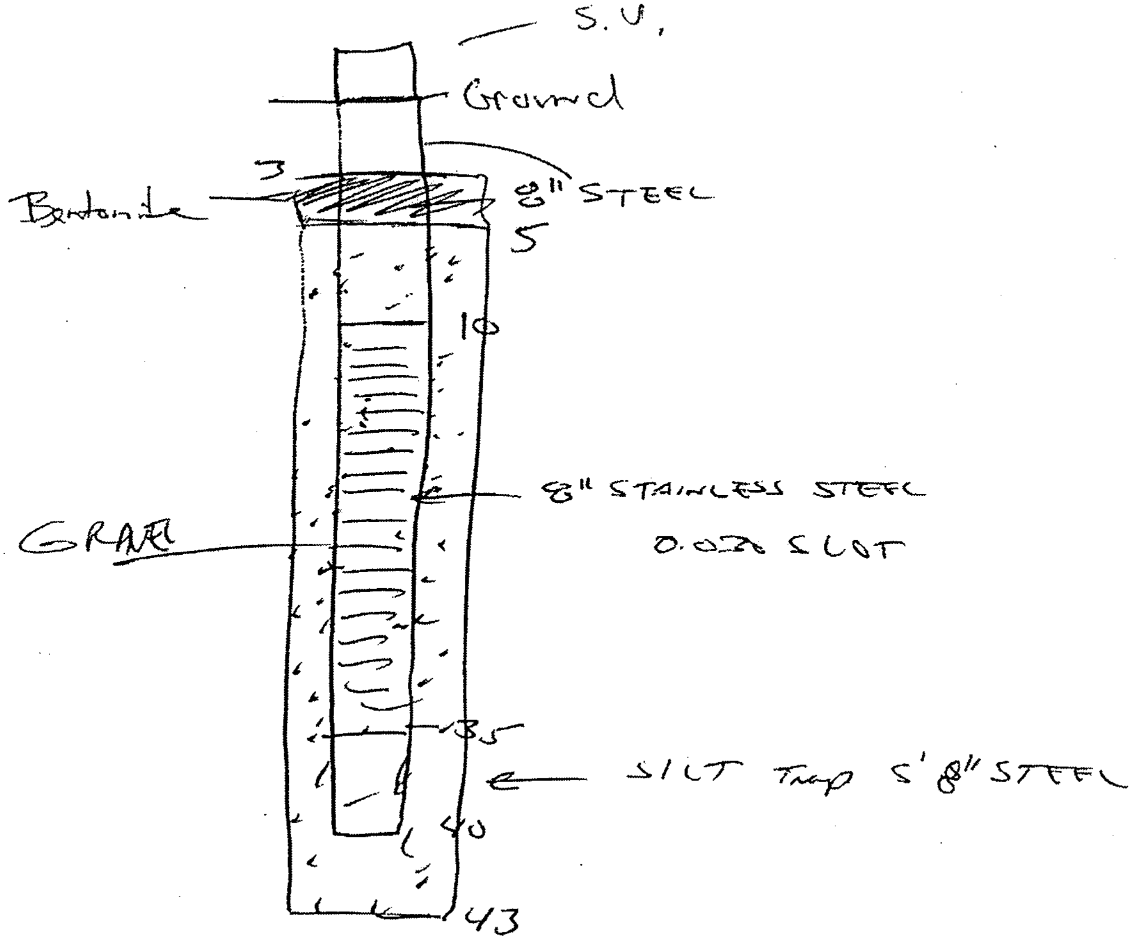
Sampleg.xls

Water
Fluid.

RW-1

12" Borehole

23 Bags
Gravel



LAWGIBB GROUP

Sample/Core Log

SITE NAME
SITE LOCATION

Boring/Well RW-2 Project/No. 22000-0-0519 Page 1 of

Site Location Agir Ind. - Lindenhurst, NY Drilling Started 6/7/01 Drilling Completed 6

Total Depth Drilled ____ Feet Hole Diameter 12 inches Type of Sample/Coring Device cuttings

Length and Diameter of Coring Device ____ Sampling Interval — feet

Land-Surface Elev. ____ feet ☐ Surveyed ☐ Estimated Datum ____

Drilling Fluid Used Mud Drilling Method HSA/Mud Rotary

Drilling Contractor Summit Drilling Driller MATT Helper Brian/[illegible]

Prepared By Scott Horsnall Hammer Weight — Hammer Drop — ins.

Background PID Ø ppm

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	Time/Hydraulic Pressure or Blows per 6 Inches	Sample/Core Description
0.0	10.0			Orange-brown sand (f-m) with gravel
				(f-m) s. rounded qtz
				water ~3' bgs
				0-10 Hollow STEM Auger
				12" Mud Rotary
				Gravelly @ 15'
10	21			TAN ~~Orange~~ brown sand (f-c) and gravel
				(f-c) s. rounded, qtz s. angular
				feldspar, angular rock frag
21.				Tan Brown sand (f-c) with ~~and~~ gravel (f-c)
30	32.0			TAN Brown sand (f-c) and gravel (f-c)
				and pea Gravel
32/32	45			TAN Brown sand (f-c) with gravel
				(f-c)

12
37
42

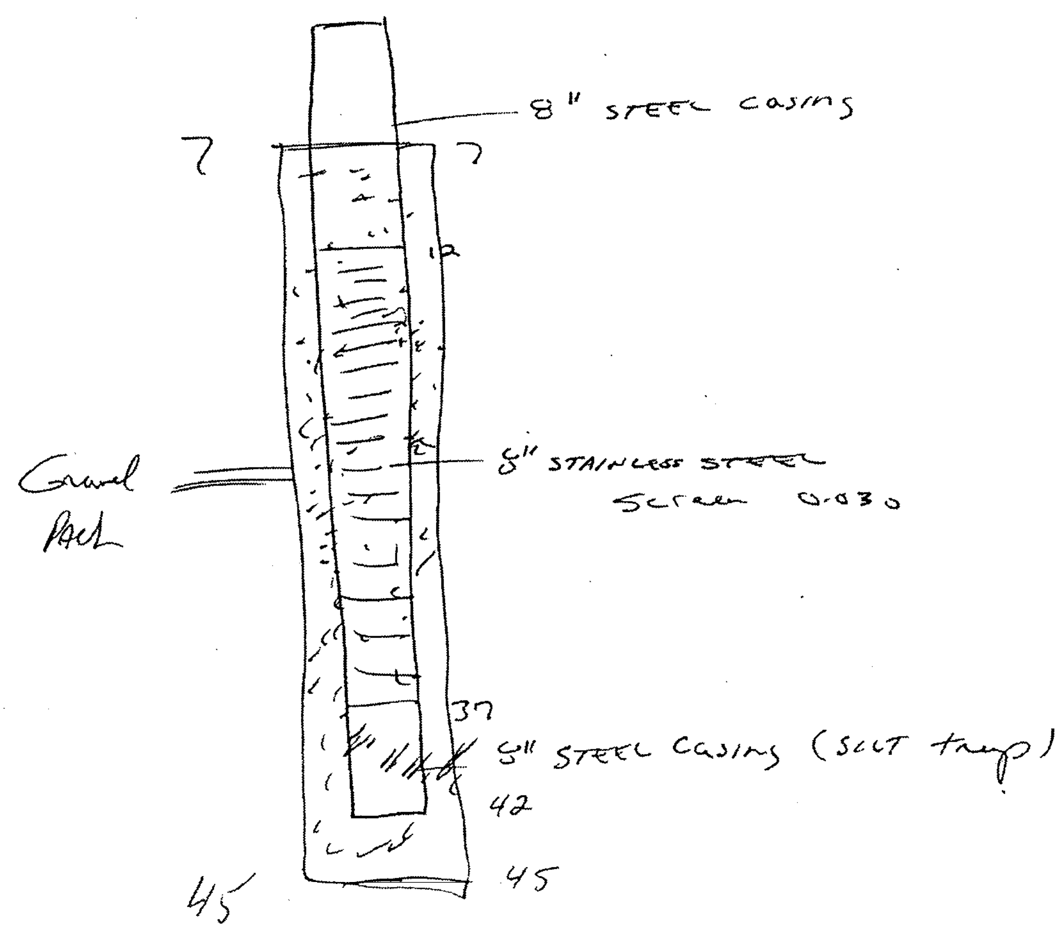
Sampleld xls

RW-2

12" Borehole

0-10 HSA

10-45 mud Rotary



APPENDIX E

Sub-Slab Vapor Intrusion Installation Report

SUB-SLAB VENTILATION SYSTEM INSTALLATION REPORT
608 Tompkins Lane, Lindenhurst, NY

ACTIVE INDUSTRIAL UNIFORM SITE - SITE # 152125
WORK ASSIGNMENT NO. D004434-26

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC Project No. 3612072086

SEPTEMBER 2009

SUB-SLAB VENTILATION SYSTEM
INSTALLATION REPORT
608 Tompkins Lane, Lindenhurst, NY

ACTIVE INDUSTRIAL UNIFORM SITE - SITE # 152125
WORK ASSIGNMENT NO. D004434-26

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

MACTEC Engineering and Consulting, P.C.
Portland, Maine

MACTEC Project No. 3612072086

SEPTEMBER 2009

Submitted by:

Eric C. Sandin
Project Manager

Approved by:

John W. Peterson
Principal Professional

TABLE OF CONTENTS

LIST OF FIGURES

Figure

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ESI	Ecosystems Strategies, Inc.
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	tetrachloroethene
SSV	Sub-Slab Ventilation
TCE	trichloroethene
VOC	Volatile Organic Compound
WC	Water Column

1.0 INTRODUCTION

The purpose of this document is to provide information on an active Sub-Slab Ventilation (SSV) System installed at 608 Tompkins Lane, Lindenhurst, New York. The SSV system was provided by the New York State Department of Environmental Conservation (NYSDEC) to limit the potential for intrusion of soil vapors through cracks and openings in the foundation. The structure at 608 Tompkins Lane is adjacent to the Active Industrial Uniform site (Site # 1-52-125), the location of a former dry cleaning operation. Volatile organic compounds (VOCs) such as tetrachloroethene (PCE) and trichloroethene (TCE) are present in shallow soils and groundwater at the Site. The NYSDEC is operating a groundwater extraction and treatment system which, along with prior remediation, is actively mitigating ongoing impacts from the Site. However, residual VOCs can potentially volatilize and migrate in soil gas to nearby structures.

MACTEC Engineering and Consulting, P.C. was retained by the NYSDEC to design and oversee the installation of an SSV system. The system uses a fan and piping to create a preferential pathway for soil vapors to move from beneath the building to the outside of the building. A report provided by the system installer presents the system details, photographs, specifications, and warranty information and is provided in Appendix A. For further information on soil vapor intrusion, PCE and TCE, please refer to the New York State Department of Health (NYSDOH) fact sheets provided in Appendices B through D.

2.0 DESCRIPTION OF THE SUB-SLAB VENTILATION SYSTEM

The SSV system that has been installed in the building consists of an extraction point, polyvinyl chloride piping, a u-tube manometer, and a fan. The components of a typical SSV system are shown in Figure 2.1. As designed, the fan draws air from the soil beneath the building at the extraction point and discharges it above the roofline at the vent location. The fan will also draw moisture into the tubing that will condense on the walls of the tubing. The system is designed to allow condensation to drain around the fan and discharge to the subsurface through the extraction point. The manometer measures the pressure in the SSV piping verifies that the system is operating properly.

3.0 INSTALLATION AND WARRANTY INFORMATION

The As-Built SSV System Plan for this installation is shown in Figure 3.1. The system was installed by Ecosystems Strategies, Inc. (ESI), a NYSDOH-Certified Mitigation Contractor. ESI states that they will provide a two (2) year warranty on the system and that this warranty is transferrable if the property is sold. The wiring for the fan was completed by Go West Electric, a Suffolk County licensed electrical contractor (Suffolk County License Number: 36253). The fan installed is the Fantech model HP-220. Because the system was professionally designed and installed the fan is under warranty for five years.

Warranty information can be found at:

1) ESI Warranty Statement is located in Appendix A (in Appendix F of ESI Final Report.
2) Fan Warranty and Bill of Sale is located in Appendix A (in Appendix D of ESI Final Report).

4.0 HOW TO CHECK THAT THE SYSTEM IS OPERATING PROPERLY

The manometer should be used to verify that the system is operating properly. A manometer reading of zero indicates system failure, and a manometer reading significantly less than the original reference reading noted on the label (approximately 2.6 W.C.) indicates degradation of the system. Please refer to the photographs appended to the Ecosystems Installation Report (Appendix A) for a picture of the manometer operating properly. If the system was not operating, the fluid levels in the u-tube would be at equal heights. If either of these two situations has occurred, then service is required. Please contact the NYSDEC project manager Mr. Brian Jankauskas at 518-402-9620 to arrange for a service visit.

5.0 MAINTENANCE AND INSPECTION OF THE SYSTEM

The system requires minimal maintenance. The primary method of evaluating the systems operation is by the property occupant. Periodic (e.g., every 3 months) assessments are suggested to verify that the system is operating properly based on the information provided in Section 4.0. If a problem is identified, please contact the NYSDEC project manager Mr. Brian Jankauskas at 518-402-9620 to arrange for a service visit.

Audits may be performed by NYSDEC to evaluate performance of the system. These may include:

- Inspection of the manometer to see if there is failure or degradation of the system.
- Inspection of the extraction point to see that it has remained sealed.
- Inspection of piping and vent stacks for cracks or leaks on interior and exterior of the building.
- Inspection of fan and rubber mounts for leaks.
- Inspection of electrical connection and test of cut off switch by turning the switch on an off.
- Collection of air samples while the fan is operating and is idle.

6.0 CONTACT INFORMATION

Comments or questions regarding the system, please contact the NYSDEC project manager Mr. Brian Jankauskas at 518-402-9620.

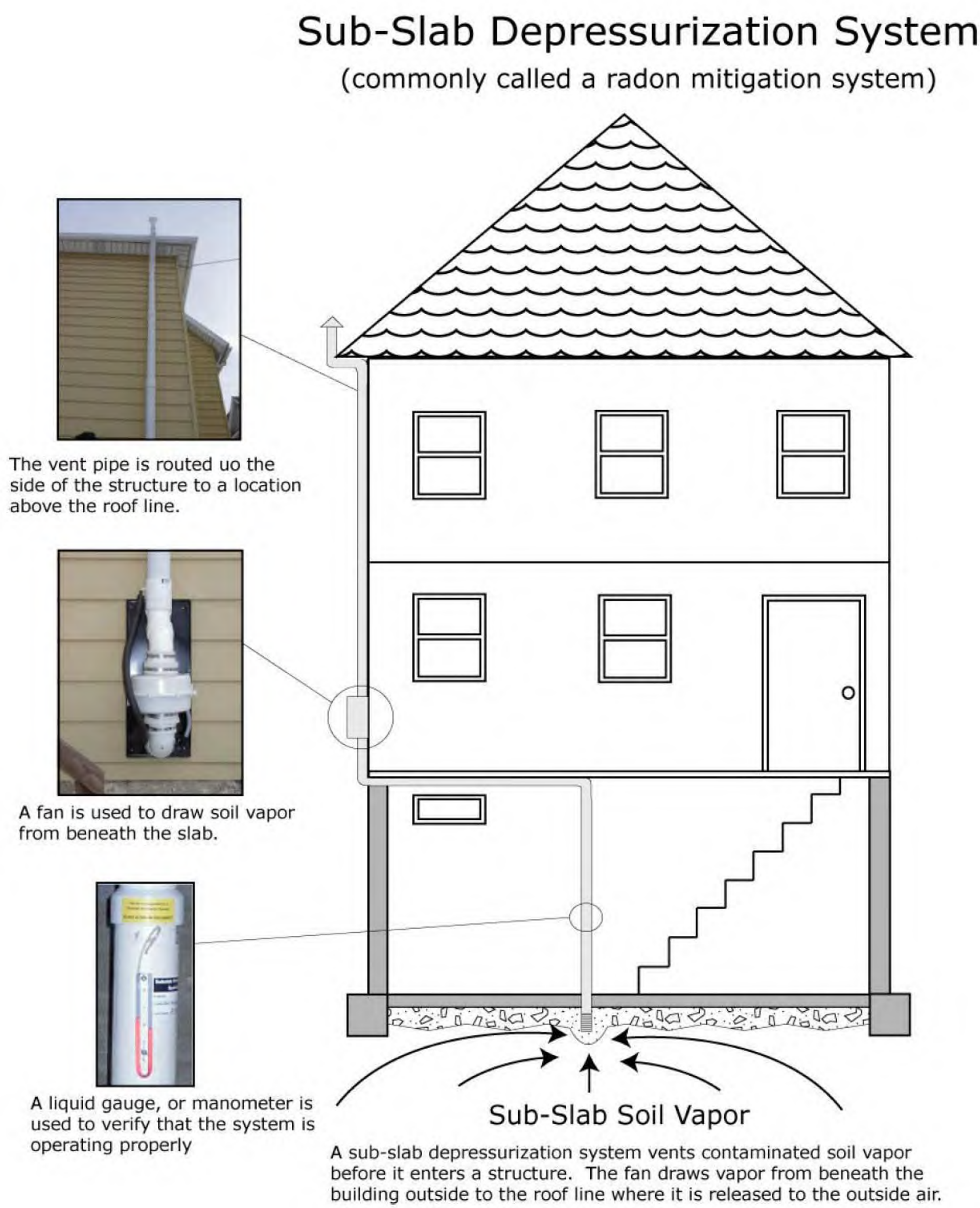
7.0 SUPPORTING DOCUMENTS

The following documents are attached:

- Final Report for Sub-slab Ventilation System Installation. This report was provided by the system installer and presents the system details, photographs, specifications, and warranty information.
- NYSDOH Soil Vapor Intrusion Frequently Asked Questions
- NYSDOH Fact Sheets for Tetrachloroethene and Trichloroethene in Indoor Air and Outdoor Air

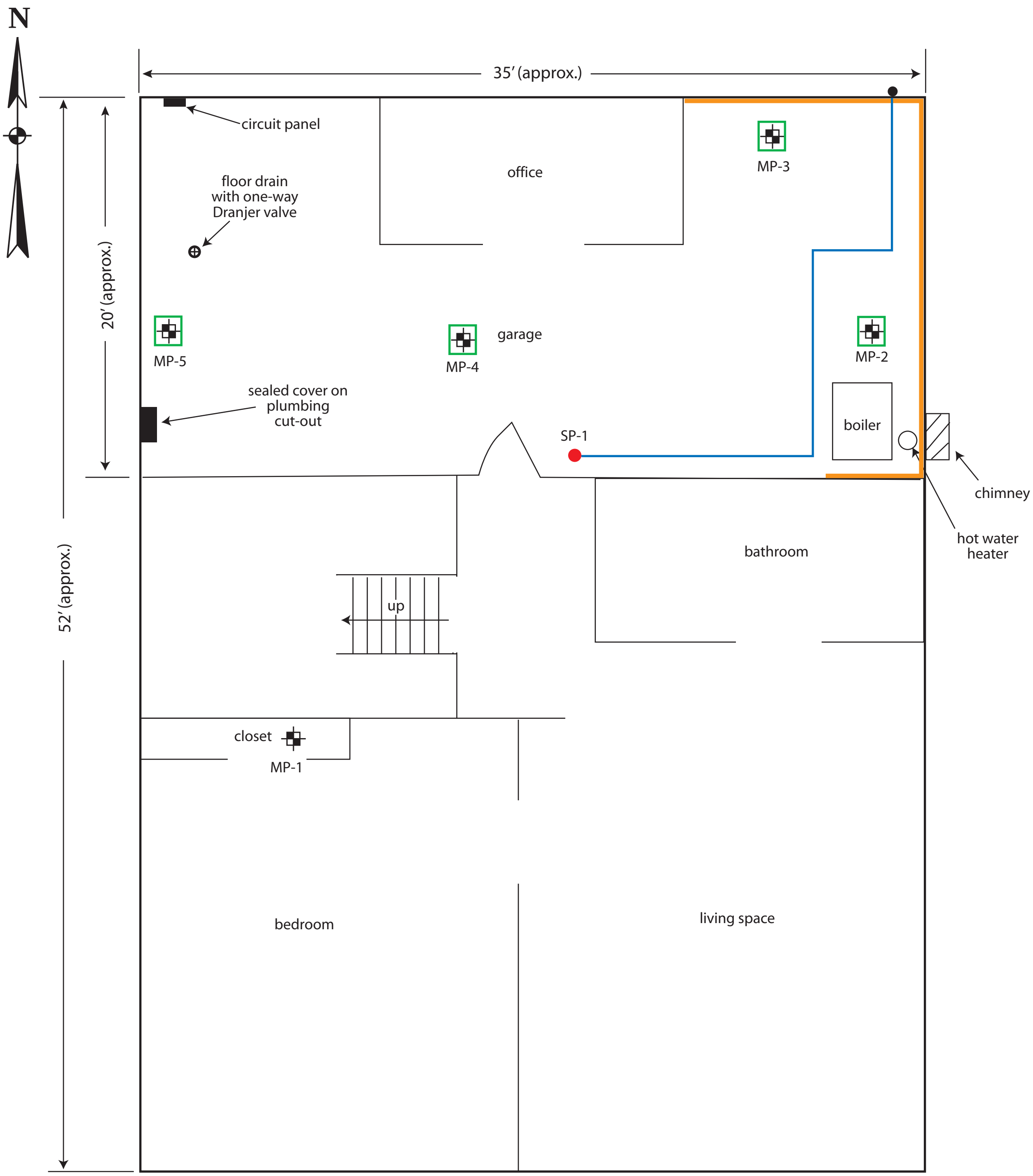
FIGURES

Figure 2.1



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

Ecosystems Strategies, Inc.



All feature locations are approximate. This map is intended as a schematic to be used in conjunction with the associated report, and it should not be relied upon as a survey for planning or other activities.

As-Built SSV System Plan

608 Tompkins Lane
Village of Lindenhurst
Suffolk County, New York

Legend:
- fan & vertical riser location (discharge point above eave of bldg.)
- system piping (4" schedule 40 PVC)
- permanent monitoring point
- perimeter sealing
- temporary monitoring point
- suction point

ESI File: ML09022.30

July 2009

Scale as shown

Figure 2.1

Source: Ecosystems Strategies, Inc., 2009. Final Report for Sub-Slab Ventilation System Installation.

APPENDIX A

FINAL REPORT FOR SUB-SLAB VENTILATION SYSTEM INSTALLATION

FINAL REPORT

FOR

SUB-SLAB VENTILATION SYSTEM INSTALLATION

Prepared for the
Active Industrial Uniform Site

Village of Lindenhurst
Suffolk County, New York

Site Number: 1-52-125
NYSDEC Program Number: D004434-26

ESI File: ML09022.30R

Date of Preparation: July 2009
– REVISED September 2009

Ecosystems Strategies, Inc.

24 Davis Avenue, Poughkeepsie, NY 12603
phone 845.452.1658 | fax 845.485.7083 | ecosystemsstrategies.com

Ecosystems Strategies, Inc.

FINAL REPORT

FOR

SUB-SLAB VENTILATION SYSTEM INSTALLTION

Prepared for the
Active Industrial Uniform Site

Village of Lindenhurst
Suffolk County, New York

Site Number: 1-52-125
NYSDEC Program Number: D004434-26

ESI File: ML09022.30R

Date of Preparation: July 2009
– REVISED September 2009

Prepared By:

Ecosystems Strategies, Inc.
24 Davis Avenue
Poughkeepsie, New York 12603

Prepared For:

MACTEC Engineering and Consulting, P.C.
511 Congress Street
P.O. Box 7050
Portland, ME 04112-7050

The undersigned has reviewed this Final Report for Sub-Slab Ventilation System Installation and certifies to MACTEC Engineering and Consulting, P.C. that the information provided in this document is accurate as of the date of issuance by this office.

Paul H Ct

Paul H. Ciminello
President

TABLE OF CONTENTS

1.0 OVERVIEW

1.1 Introduction

This Final Report for Sub-Slab Ventilation System Installation (Final Report), prepared by Ecosystems Strategies, Inc. (ESI), documents the installation and testing of a sub-slab ventilation (SSV) system within the residential structure located at 608 Tompkins Lane in the Village of Lindenhurst, Suffolk County, New York (hereafter referred to as the Site). All system installation work was performed at the Site by ESI, or designated ESI sub-contractors, on June 15, 2009. System installation methodology, testing, and observations are discussed in applicable sections below. ESI's recommended system operation and maintenance protocol is provided in Appendix E, and a statement of ESI's system warranty is provided in Appendix F.

All work detailed herein was conducted in accordance with the associated MACTEC Engineering and Consulting, P.C. (MACTEC) Scope of Work (SOW), dated July 2008; the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York (NYSDOH Guidance), dated October 2006; the American Society for Testing Materials (ASTM) Standard Practice for Installing Radon Mitigation Systems in Existing Low-Rise Residential Structures (ASTM E2121), dated February 2003; ESI's Final Work Plan for Sub-Slab Ventilation System Installation (Final Work Plan), dated May 2009, and site-specific Health and Safety Plan (HASP), dated March 2009; and, applicable local/national building regulations and codes.

2.0 SUB-SLAB VENTILATION SYSTEM INSTALLATION

2.1 Permitting and Inspections

In accordance with local regulations, a building permit was acquired from the Village of Lindenhurst Building Department prior to the start of installation work at the Site. Building permit number 25328 was assigned to the project on June 11, 2009. An electrical inspection was conducted by the New York Board of Fire Underwriters on July 7, 2009 and a Certificate of Occupancy (CO) was issued by the Building Department on July 20, 2009, indicating that all applicable code requirements had been met, and that the building permit had effectively been closed. A copy of the building permit (unofficial copy), electrical inspection certificate, and CO are provided in Appendix A of this Final Report.

2.2 Pre-Installation Communication Testing

On June 15, 2009, prior to the start of any installation work, ESI performed sub-slab communication testing in order to determine if the proposed SSV system design, as described in the Final Work Plan, was capable of creating adequate negative pressure below the building slab. Adequate negative pressure has been defined by MACTEC to be a minimum pressure change of -0.025 inches of water column (W.C.).

Communication testing was conducted by creating pressure monitoring points through the building slab. Each monitoring point was created by breaching the slab with a ½" concrete drill bit. A 6.0 horsepower shop vacuum was used to apply vacuum at the proposed suction point location (at the eastern end of the garage), and an Infiltec digital micro-manometer (pressure resolution of 0.001 W.C. and 0.01 Pascals [Pa]), was used to collect pressure data at the monitoring points. The data collected from this initial testing indicated that the proposed suction point location was not capable of creating negative pressure at all of the pressure monitoring points.

An alternate suction point (SP-1) was selected behind the interior garage door, located in the south-central portion of the garage, and additional communication testing was conducted to determine the viability of the suction point. Table 1, below, presents the results of the communication testing performed while applying suction to SP-1. The approximate locations of SP-1 and the pressure monitoring points (MP-1 through MP-5) are depicted on the As-Built SSV System Plan provided in Appendix B.

Table 1: Pre-Installation Communication Test Results for SP-1
All data provided in inches of water column (W.C.).

Monitoring Point	Initial Pressure – Vacuum Off	End Pressure – Vacuum Applied to SP-1
MP-1	0.000	-0.003
MP-2	0.000	-0.002
MP-3	0.000	-0.002
MP-4	0.000	-0.014
MP-5	0.000	-0.018

The results of the communication testing at SP-1 indicated that suction applied to that point was able to induce negative pressure at all monitoring points; however, the total pressure change at each monitoring point did not meet the MACTEC minimum pressure requirement of -0.025 W.C. Although the minimum pressure requirement was not met, system pressure was expected to improve following construction of the suction pit and sealing of openings in the building slab. SP-1 was concluded to be the final system suction point location, and system installation was initiated.

2.3 Final System Design and Installation Methodology

The final system design was determined through communication testing, observations of the Site layout, and consultation with the homeowner and MACTEC. A discussion of the final system design and installation methodology is provided below. The final system design, as well as other relevant Site features, is depicted on the As-Built SSV System Plan provided in Appendix B. Photographs of the system are provided in Appendix C.

2.3.1 System Suction Point

Given the results of the communication testing, the system suction point (SP-1) was located behind the interior garage door, in the south-central portion of the garage. The suction point was created by breaching the building slab with a 5-inch concrete core bit. A sufficient volume of material (enough to roughly fill a 5-gallon pail) was removed from below the slab to create a suction pit. A 4-inch Schedule 40 PVC coupler was hammered into the slab hole to provide easy connection for associated suction piping, and to enhance pipe stability at the slab penetration. A urethane-based concrete/masonry sealant was applied around the suction point slab penetration to create an air-tight seal.

[Note: It was observed that the material underlying the slab consisted of very fine sand and silt, intermixed with small cobbles (1- to 2-inch diameter), and that the material was firmly packed against the bottom of the slab (i.e., no void exists between the slab and underlying material). This sub-slab material, and the observed compaction, is not conducive to good sub-slab air movement, as indicated by the results of the pre-installation communication testing. Although the communication test results did not meet the minimum pressure requirement, the data did indicate that the selected suction point location was capable of inducing a negative pressure change at each monitoring point, which is likely to be suitable to intercept any associated contaminant vapors.]

2.3.2 Suction Piping

The suction piping installed at the Site consists of 4-inch Schedule 40 PVC. Suction piping was installed vertically above the suction point, to just below ceiling height. Horizontal piping was then installed over-head toward the eastern end of the garage. At the eastern end of the garage near the boiler, additional horizontal piping was installed overhead toward the northeast corner of the building. The piping was installed through the northern building wall (near the northeast corner), in the location of the exterior-mounted system fan (see Section 2.3.3, below). Piping was then installed vertically above the system fan, where it was terminated approximately two feet above the eave of the roof (discharge point).

All pipe unions were cemented using low-volatile organic compound (VOC) emitting PVC glue. In accordance with ASTM E2121 protocol, pipe supports (i.e., galvanized pipe straps and pipe clips) were installed at least every six feet on horizontal pipe runs, and at least every eight feet on vertical pipe runs. A positive slope (at least 1/8" per linear foot of pipe) was maintained in order to allow draining of internal condensation toward the suction point. A PVC rain cap was installed on the pipe terminus (discharge point) to prevent excessive internal moisture and entrance of foreign materials (e.g., leaves or small animals).

2.3.3 System Fan

As specified in the Final Work Plan, the system fan installed at the Site is the Fantech model HP-220. A copy of the manufacturer's fan specifications, including a statement of warranty, is provided in Appendix D.

In order to maintain a positive pipe slope, alleviate issues with proximity of the discharge to windows, and maintain building aesthetics, the system fan was located at the northern building exterior, near the northeast corner. The fan was installed approximately eight feet above ground surface and was mounted directly to the suction piping using 6-inch by 4-inch flexible couplers with steel draw bands. A Fan Guard drain system was installed on the system piping immediately above the fan, to intercept internal moisture and allow it to drain around the system fan.

Wiring of the system fan was completed by Go West Electric, a Suffolk County licensed electrical contractor (Suffolk County License Number: 36253). A system switch was wired to the system fan and mounted on the building exterior within two feet of the fan. Associated wiring was installed from the fan switch, along the exterior of the building, to the building circuit panel located in the northwest corner of the garage. All external wiring was housed in external-grade conduit, and the system switch was housed in a weather-proof, external-grade box.

2.3.4 Sealing

Applicable openings in the building slab (i.e., openings determined by ESI to be likely points of system vacuum loss and/or vapor intrusion) were sealed by ESI in order to increase the effectiveness of the system. The following sealing work was conducted:

- The gap between the foundation wall and slab along the perimeter at the eastern end of the garage was sealed using a urethane-based concrete/masonry sealant and expanding foam (used in areas where the gap was significantly wide).

- A one-way Dranjer valve was installed in the floor drain at the western end of the garage. The valve allows water to drain from above while maintaining an air-tight seal that prevents system vacuum loss and the intrusion of sub-slab vapors.

- A ¼" thick, clear Lexan cover was installed on a plumbing cut-out located in the southwest corner of the garage. A pliable elastomeric sealant was used to create an air-tight seal around the cover. The pliable sealant allows the cover to easily be removed and replaced as needed, providing access to the sewage clean-out.

2.3.5 System Fail-Safe Device

A u-tube manometer was installed on the vertical suction piping above the suction point and serves as the system fail-safe device. The u-tube manometer was securely attached to the piping with a fastening screw and associated pressure tubing was inserted directly into the system suction pipe. The u-tube manometer measures internal system pressure (in units of W.C.) and is an indicator that the system fan is operating.

2.3.6 Permanent Pressure Monitoring Point

In accordance with the Final Work Plan, a permanent pressure monitoring point was installed at the Site. Monitoring point MP-1, located in the bedroom closet in the southwest portion of the basement, was selected as the permanent monitoring point location.

The permanent monitoring point was created using a barbed hose fitting connected to ¼”-diameter polyethylene tubing via a plastic tube snap-connector fitting. Associated tubing was inserted through the slab penetration to just below slab depth, and the barbed fitting was recessed below the slab surface to prevent damage and maintain storage space in the closet. The point was set firmly in place using cement patch and the barbed fitting was capped to maintain an air-tight seal. The closet was restored to normal conditions to allow for replacement of stored items.

2.3.7 Air Sample Port

An air sample port was installed on the system piping just above the system fan, on the exterior of the building. The sample port consists of a brass ball valve and barbed hose fitting, which allows for screening and sampling of the system effluent air, if needed.

3.0 SYSTEM START-UP AND TESTING

3.1 Start-Up and System Check

Following completion of system installation, all system components were checked:

- The system fan was started and noted to be functioning properly;
- The system fan switch and fan breaker were tested and found to be functioning properly;
- All piping and supports were inspected and noted to be firmly in place;
- All sealing work was inspected and chemical smoke was utilized to determine the presence or absence of any leaks. No leakage was observed in any of the sealed areas;
- The system u-tube manometer was inspected and noted to be functioning properly; and,
- System piping above the suction point was labeled with ESI's contact information and instructions on how to read the u-tube manometer. The initial u-tube manometer reading (approximately 2.6 W.C.) was recorded on the label as the reference pressure.

3.2 Post-Installation Communication Testing

Post-installation communication testing was conducted following system installation, in order to verify the presence of negative pressure at each of the previously created monitoring points. Table 2, below, depicts the results of the post-installation communication testing.

[Note: All temporary monitoring points (MP-2 through MP-5) were appropriately sealed with hydrated bentonite clay chips and concrete patch following the collection of post-installation communication test data.]

Table 2: Post-Installation Communication Test Results
All data provided in inches of water column (W.C.).

Monitoring Point	Initial Pressure – System Off	End Pressure – System On
MP-1 (permanent point)	0.000	-0.006
MP-2	0.000	-0.003
MP-3	0.000	-0.005
MP-4	0.000	-0.004
MP-5	0.000	-0.015

The results of the post-installation testing showed a general improvement from the readings collected from the pre-installation testing. The recorded pressure readings did not meet the MACTEC design criteria of -0.025 W.C but do indicate a negative pressure influence at each monitoring point. Given the presence of compacted sub-slab material with minimal pore space, it is concluded by ESI that this pressure requirement cannot be met with the specified system fan (HP-220).

These data do, however, verify a negative pressure influence at each monitoring point. The suction indicated by the recorded readings, in ESI's experience, is likely to be sufficient to adequately intercept and reduce sub-slab chlorinated solvent vapors, thereby improving indoor air quality at the residence. Should it be determined by MACTEC, through post-installation air sampling, that indoor air quality guidelines have not been met, ESI would recommend the installation of a system fan with greater vacuum capacity, such as one of the RadonAway GP-series fans.

3.3 Back-Draft Inspection and Testing

The potential exists that an active SSV system may create back-drafting of combustion gasses (e.g., carbon monoxide) from natural draft combustion appliances (fuel burning appliances with open flue hoods that rely on natural convective flow to exhaust combustion gasses to the outside air). ESI performed an inspection for the presence of any natural draft combustion appliances and a natural draft hot water heater and boiler were observed.

In accordance with the MACTEC SOW, ESI performed a back-draft test on both appliances following the SSV system installation and start-up. Given the on-site features (combustion appliances, exhausts, etc.) the following back-draft test procedures were followed:

1) The SSV system was turned on.

2) All windows and doors, both external and internal, were closed.

3) The fireplace damper was closed.

4) The kitchen gas range was turned on.

5) All bathroom exhaust fans were turned on. [Note: A whole-house attic fan is present at the Site. This fan is thermo-regulated, and according to the homeowner, no other controls exist to regulate the fan's operation. Information provided to ESI indicated that this fan was in operation during the back-draft evaluation.]

6) Approximately five minutes was allowed to pass and an assessment of the indoor/outdoor pressure differential was made at the garage window next to the boiler and hot water heater, using a digital micro-manometer. A reading of approximately 1.4 Pa was recorded.

7) Both the boiler and hot water heater were turned on and allowed to operate for approximately five minutes.

8) A chemical smoke test was conducted by introducing chemical smoke in the vicinity of each flue hood. No significant spillage was noted around either hood.

9) A final indoor/outdoor pressure differential of approximately 2 Pa was recorded using a digital micro-manometer.

The results of the back-draft test indicated that the indoor/outdoor pressure differential was below the 5 Pa maximum pressure differential defined in the MACTEC SOW. Chemical smoke testing indicated that no significant spillage of combustion gases was occurring. These data verify that no back-drafting of combustion gasses is likely to occur at the Site; however, as a precautionary measure, ESI provided the homeowner with a Kidde carbon monoxide alarm and instructed the homeowner to install the alarm in a bedroom within the home.

4.0 CONCLUSIONS AND RECOMMENDATIONS

This office has completed the installation and testing of a sub-slab ventilation (SSV) system at the property located at 608 Tompkins Lane, Village of Lindenhurst, Suffolk County, New York. Based on the services provided and data generated, the following conclusions, and applicable recommendations (in **bold**), have been made.

1. Pre-installation communication testing indicated that the proposed suction point, as indicated in the Final Work Plan, was not capable of creating a negative pressure influence at all monitoring points. The final system suction point (SP-1), relocated to the south-central portion of the garage, was determined to be effective at creating a negative pressure influence at all monitoring points, and the system design (see Paragraph 2, below) was modified to accommodate this change.

2. Following determination of the final suction point location, the system design was reconfigured so that a positive slope was maintained on all suction piping, building aesthetics were maintained, and the system discharge point was appropriately located with respect to proximity to building windows. All system piping was routed overhead from the location of SP-1, to the location of the system fan at the northeast corner of the building. All system materials and installation work, including the fan wiring, were consistent with the standards set forth in the MACTEC SOW, NYSDOH Guidance, ASTM E2121, and ESI's Final Work Plan.

3. In order to increase the effectiveness of the system, and to mitigate potential vapor intrusion pathways, ESI sealed the eastern perimeter of the garage, installed a one-way valve on an existing floor drain, and installed a sealed cover on an existing plumbing cut-out.

   No further sealing work is recommended at this time; however, the homeowner should be advised to inspect for damage to sealed areas, and for the formation of any new openings that may be potential vapor intrusion pathways. Any damage to sealed areas, or formation of new openings, should be reported to the NYSDEC for corrective action.

4. The system was started and all system components were inspected and found to be operational. The system was equipped with a failsafe device, and associated labeling, and the homeowner was instructed on how to read the device.

   In accordance with local regulations, all system installation work was inspected by the Village of Lindenhurst Building Inspector, and the system was found to be in compliance applicable local/national building regulations and codes.

   No additional "formal" system inspections are required at this time; however, the homeowner should be informed of appropriate operation and maintenance protocol (such as that provided as Appendix E of this document), which should include routine general inspections of the system.

5. Post Installation pressure testing indicates that the system is capable of creating a negative pressure influence at the permanent monitoring point (MP-1), and each of the temporary monitoring points. The recorder pressure readings, however, fall short of the MACTEC minimum pressure requirement of -0.025 inches of water column (W.C.), as specified in the MACTEC SOW.

   ESI's observations indicate that sub-slab material at the Site is a tightly compacted, fine sand and silt. It is ESI's conclusion that the minimum pressure requirement cannot be met with the specified system fan (Fantech HP-220), given the presence of this type of sub-slab material. In ESI experience, the suction indicated by the negative pressure is likely to be sufficient to adequately intercept and remove contaminant vapors from below the building slab; however, a fan with a higher vacuum capacity may be needed if the results of post-installation air sampling (to be conducted by MACTEC) indicate unacceptable levels of contaminant vapors in sub-slab soil gas and indoor air.

   No fan change is recommended at this time; however, if the results of post-installation air sampling indicate unacceptable contaminant levels, a fan with a greater suction capacity, such as the RadonAway GP-series, may be required.

6. The results of post-installation back-draft testing conducted on the on-site natural draft boiler and hot water heater indicate that no back-drafting of combustion gasses is likely to occur. As a precautionary measure, ESI provided the homeowner with a carbon monoxide alarm, and instructions to install the alarm in a bedroom within the house.

   No additional back-draft testing is recommended at this time; however, if a different fan is installed at the Site, a follow-up test should be conducted to verify acceptable conditions.

APPENDIX A

Permit/Certificates

INC VILLAGE OF LINDENHURST

BUILDING PERMIT
NO: 25328
TM# 22-1-24

Permission is hereby granted for the erection - alteration of the building described below, in accordance with the application

Date of Issue: 6/11/2009

Expires: 6/11/2010

THIS PERMIT WILL EXPIRE ONE YEAR FROM DATE OF ISSUE IF WORK IS NOT STARTED. PERMIT MUST BE RENEWED IF WORK IS NOT COMPLETED AND INSPECTED WITHIN TWO YEARS.

Location: 608 Tompkins Ln
Lindenhurst, NY 11757

File Map: 22-1-24

Type: Installation of a vapor mitigation system.

Remarks: Application must be submitted by 6/19/09 to legalize conversion of garage, 2nd floor deck and front bow window on property.

Owner: Massa

Contractor: Gregory Westcott/Go West Electric, Inc.

THIS PERMIT NOT VALID UNLESS IN ACCORDANCE WITH ALL ORDINANCES OF THE INC. VILLAGE OF LINDENHURST.

Thomas Maher
Building Inspector
TM

Cost Stated: $2,000.00

Fee: $65.00

THIS PERMIT MUST BE SHOWN WHEN REQUESTED.

NOTE: The holder of this permit is requested to familiarize himself with the ordinance under which said permit is granted. Any violation of the provisions of said ordinance shall render the offender liable for the penalties provided therefore, and in addition thereto may result in the immediate revocation of the permit.

BUILDING CERTIFICATE

VILLAGE OF LINDENHURST, SUFFOLK COUNTY, NEW YORK

Address of property to which this Certificate applies:
608 THOMPKINS LANE
#0103-022-01-024 LTM 49-23A FILE MAP 815 LOTS 67-70 RES. B

This certifies that the above property contains the following improvements which conform substantially with the terms and requirements of the New York State Building Code and the Village of Lindenhurst Zoning Ordinance at the time of construction and that the premises may be occupied for the purpose as stated:
Certificate of Occupancy #1965-229 issued 9/24/65 for a One Family Hi Ranch Dwelling with Two Car Internal Garage as per Building Permit #9724. Underwriters Cert. #N459692 dated 8/25/65. **

Certificate of Occupancy #2009-122 issued 7/20/09 for Installation of a Sub-slab Vapor Mitigation System as per Building Permit #25328. Underwriters Cert. #4033116 dated 7/7/09. **

The above improvements or any part thereof shall not be used for any purpose other than for which they are certified. This certificate will be null and void if the improvements are altered in any manner or additions are made thereto without authorization from the Village of Lindenhurst Building Department.

UNOFFICIAL COPY

Date:

Signature: ______________________

BY THIS CERTIFICATE OF COMPLIANCE THE

NEW YORK BOARD OF FIRE UNDERWRITERS

BUREAU OF ELECTRICITY

40 FULTON STREET ~ NEW YORK, NY 10038

CERTIFIES THAT

Upon the application of

GO WEST ELECTRIC INC
547 MOUNT HUNGER RD
LISLE, NY 13797,

upon premises owned by

CAROL MASSA
608 TOMPKINS LANE
LINDENHURST, NY 11757

Located at 608 TOMPKINS LANE LINDENHURST, NY 11757

Application Number: 4033116 **Certificate Number:** 4033116

Section: 22 Block: 1 Lot: 24 Building Permit: 25328 BDC: NS49

Described as a **Residential** occupancy, wherein the premises electrical system consisting of electrical devices and wiring, described below, located in/on the premises at:

Outside,

A visual inspection of the premises electrical system, limited to electrical devices and wiring to the extent detailed herein, was conducted in accordance with the requirements of the applicable code and/or standard promulgated by the State of New York, Department of State Code Enforcement and Administration, or other authority having jurisdiction, and found to be in compliance therewith on the 7th Day of July, 2009.

Name	QTY	Rate	Rating	Circuits	Type
Appliances and Accessories					
Exhaust Fan	1	0			F.H.P
Wiring And Devices					
Outlet	1	0			Gen, Purpose
Switch	1	0			Gen, Purpose

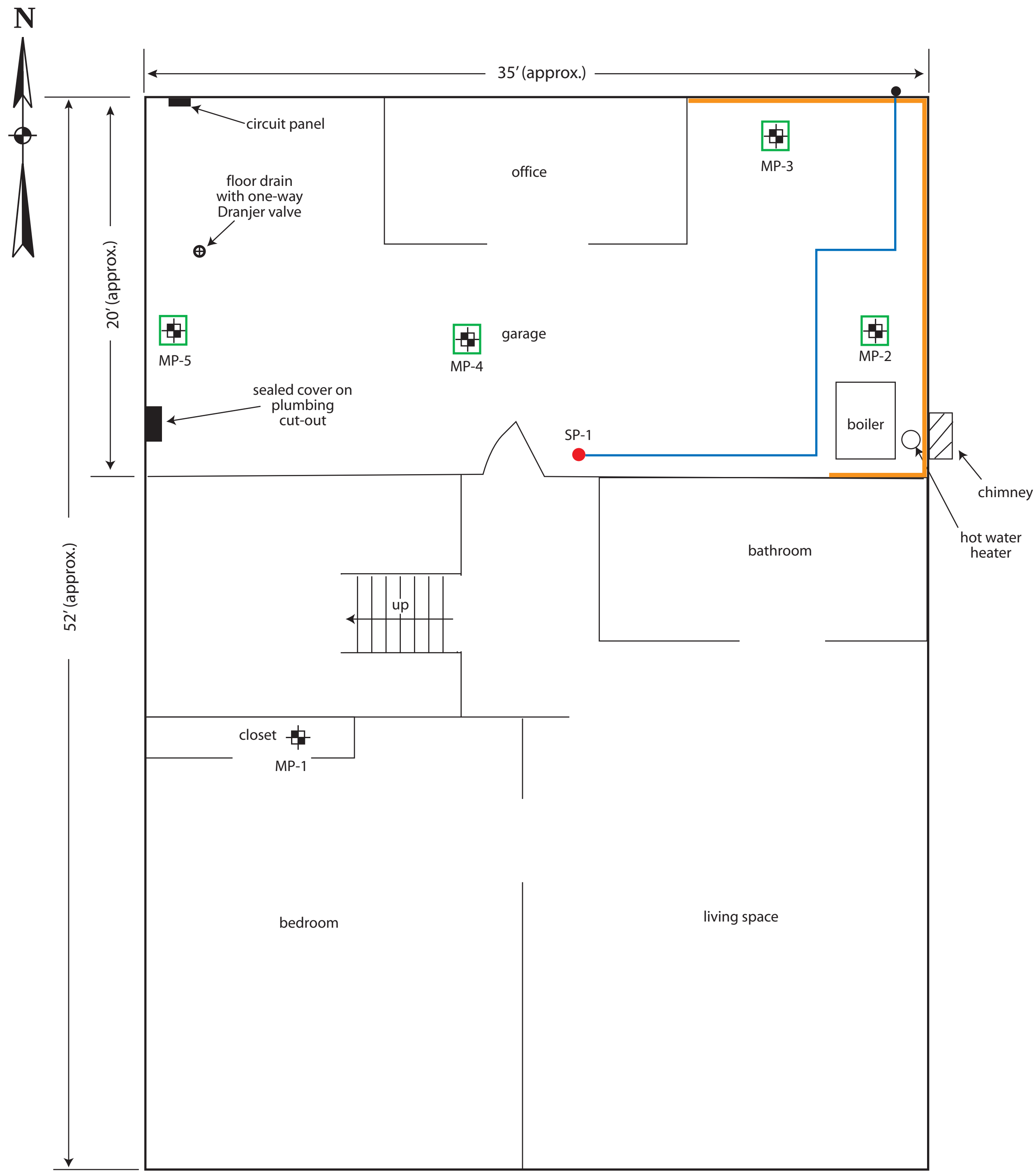
seal

This certificate may not be altered in any way and is validated only by the presence of a raised seal at the location indicated.

APPENDIX B

As-Built SSV System Plan

Ecosystems Strategies, Inc.



All feature locations are approximate. This map is intended as a schematic to be used in conjunction with the associated report, and it should not be relied upon as a survey for planning or other activities.

As-Built SSV System Plan

608 Tompkins Lane
Village of Lindenhurst
Suffolk County, New York

Legend:
- fan & vertical riser location (discharge point above eave of bldg.)
- system piping (4" schedule 40 PVC)
- permanent monitoring point
- perimeter sealing
- temporary monitoring point
- suction point

ESI File: ML09022.30

July 2009

Scale as shown

Appendix B

APPENDIX C

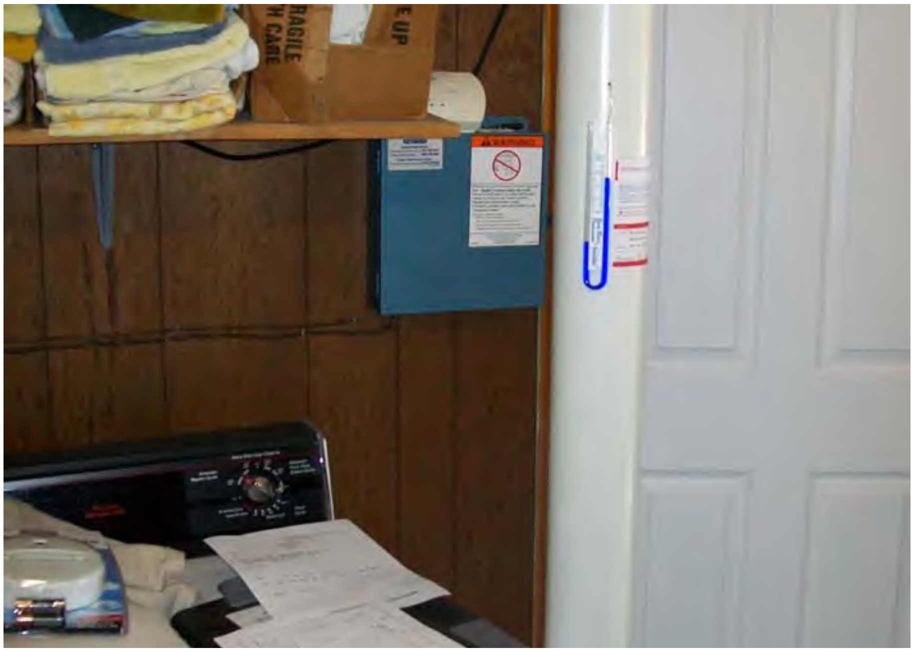
System Photographs

PHOTOGRAPHS

1. **Suction point SP-1, located behind the interior garage door at the south-central portion of the garage**

2. **Doorstop installed above SP-1, to prevent potential damage to suction piping from use of the interior garage door**

PHOTOGRAPHS

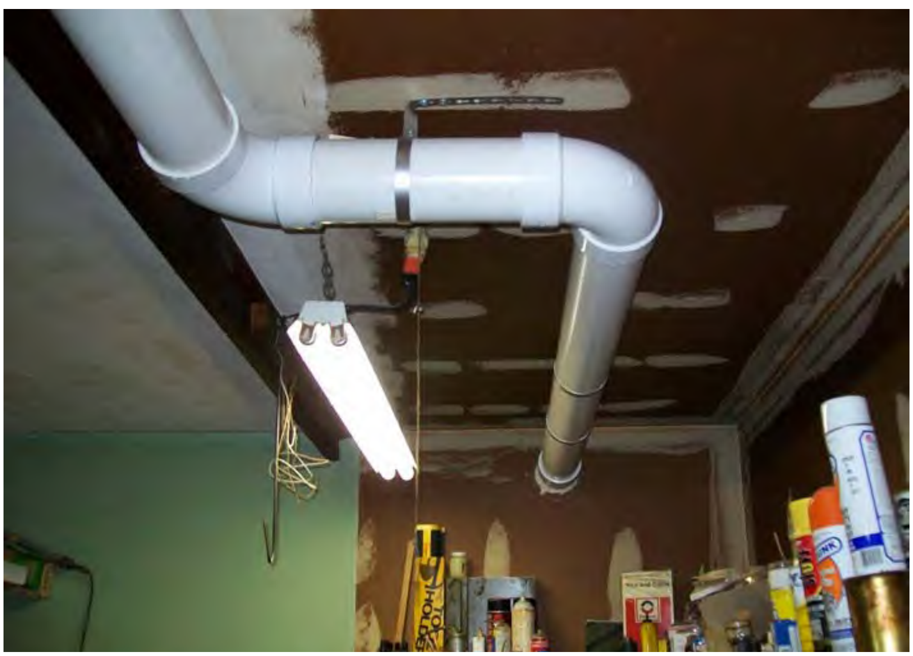


3. U-tube manometer installed on suction piping above SP-1

4. Suction piping, looking southeast toward boiler from central portion of garage

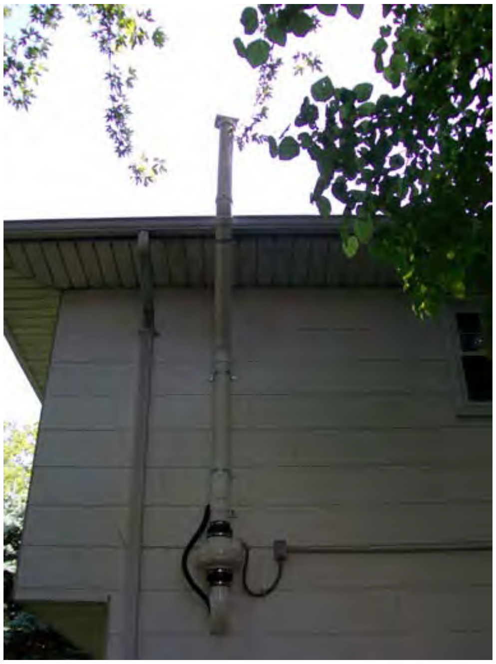
PHOTOGRAPHS

5. **Suction piping, looking south toward boiler from east-central portion of garage**



6. **Suction piping, looking north toward wall penetration from east-central portion of garage**

PHOTOGRAPHS



7. **External system features at northeast corner of building, looking south**

8. **Sealed cover installed on plumbing cut-out in southwest corner of garage**

PHOTOGRAPHS

9. One-way Dranjer valve installed in floor drain in northwest portion of garage

10. Floor drain with one-way valve in northwest portion of garage (grate replaced)

APPENDIX D

Fantech Fan Specifications, Manufacturer's Warranting Information, and Bill of Sale

Fantech

Trust the Industry Standard!

Improved UV resistance!

HP Series Fans
for Radon Applications

Why put your reputation at stake by installing a fan you know won't perform like a Fantech? For nearly twenty years, Fantech has manufactured quality ventilation equipment for Radon applications. Fantech is the fan Radon contractors have turned to in over 1,000,000 successful Radon installations worldwide.

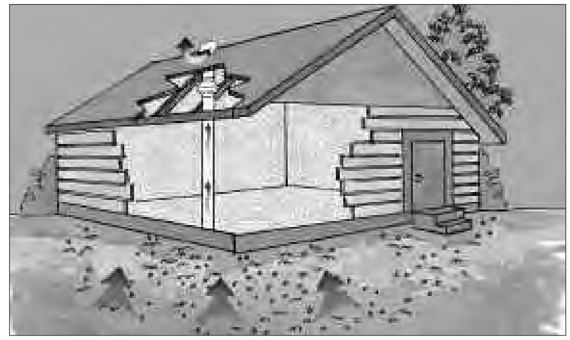
Fantech HP Series Fans Provide the Solutions to meet the challenges of Radon applications:

HOUSING
- UV resistant, UL listed durable plastic
- UL Listed for use in commercial applications
- Factory sealed to prevent leakage
- Watertight electrical terminal box
- Approved for mounting in wet locations - i.e. Outdoors

MOTOR
- Totally enclosed for protection
- High efficiency EBM motorized impeller
- Automatic reset thermal overload protection
- Average life expectancy of 7-10 years under continuous load conditions

RELIABILITY
- Five Year Full Factory Warranty
- Over 1,000,000 successful radon installations worldwide

HP Series Fans are specially designed with higher pressure capabilities for Radon Mitigation applications



Fantech has developed the HP Series fans specifically to suit the higher pressure capability requirements needed in Radon Mitigation applications. Most Radon Mitigators who previously used the Fantech FR Series fans have switched to the new HP Series.

Performance Data

Fan Model	Volts	Wattage Range	Max. Amps	CFM vs. Static Pressure in Inches W.G. 0"	0.5"	0.75"	1.0"	1.25"	1.5"	1.75"	2.0"	Max. Ps
HP2133	115	14 - 20	0.17	134	68	19	-	-	-	-	-	0.84
HP2190	115	60 - 85	0.78	163	126	104	81	58	35	15	-	1.93
HP175	115	44 - 65	0.57	151	112	91	70	40	12	-	-	1.66
HP190	115	60 - 85	0.78	157	123	106	89	67	45	18	1	2.01
HP220	115	85 - 152	1.30	344	260	226	193	166	137	102	58	2.46

HVI MEMBER™

Performance Curves

Fantech provides you with independently tested performance specifications.

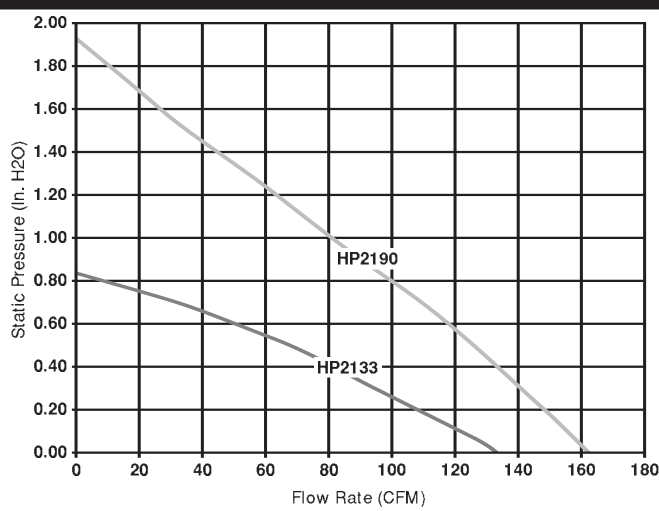
The performance curves shown in this brochure are representative of the actual test results recorded at Texas Engineering Experiment Station/Energy Systems Lab, a recognized testing authority for HVI. Testing was done in accordance with AMCA Standard 210-85 and HVI 915 Test Procedures. Performance graphs show air flow vs. static pressure.

Use of HP Series fans in low resistance applications such as bathroom venting will result in elevated sound levels. We suggest FR Series or other Fantech fans for such applications.

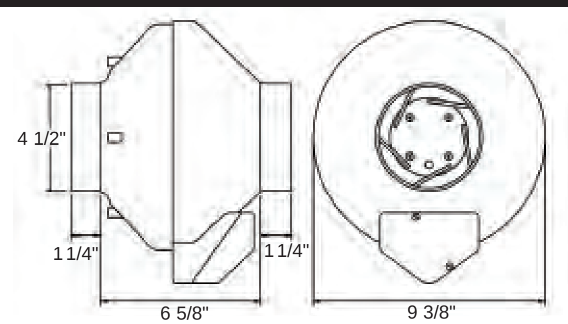
HP FEATURES INCLUDE

- Improved UV resistant housings approved for commercial applications.
- UL Approved for Wet Locations (Outdoors)
- Sealed housings and wiring boxes to prevent Radon leakage or water penetration
- Energy efficient permanent split capacitor motors
- External wiring box
- Full Three Year Factory Warranty

HP2133 and 2190 Radon Mitigation Fans



Tested with 4" ID duct and standard couplings.

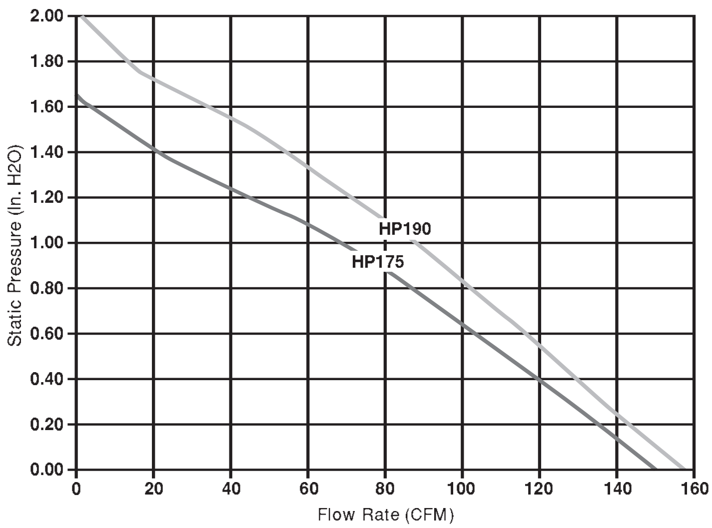


HP2133 – For applications where lower pressure and flow are needed. Record low power consumption of 14-20 watts! Often used where there is good sub slab communication and lower Radon levels.

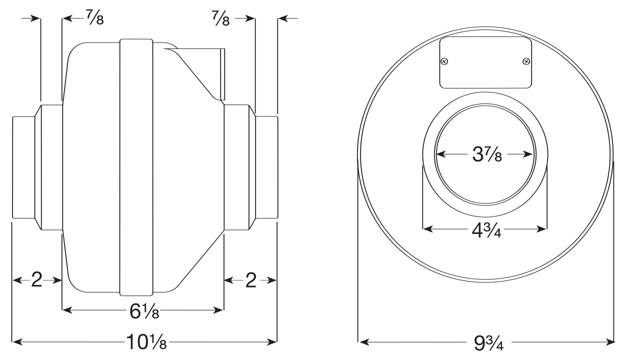
HP2190 – Performance like the HP190 but in a smaller housing. Performance suitable for the majority of installations.

Fans are attached to PVC pipe using flexible couplings.
For 4" PVC pipe use Indiana Seals #156-44, Pipeconx PCX 56-44 or equivalent.
For 3" PVC pipe use Indiana Seals #156-43, Pipeconx PCX 56-43 or equivalent.

HP175 and HP190 Radon Mitigation Fans



Tested with 4" ID duct and standard couplings.



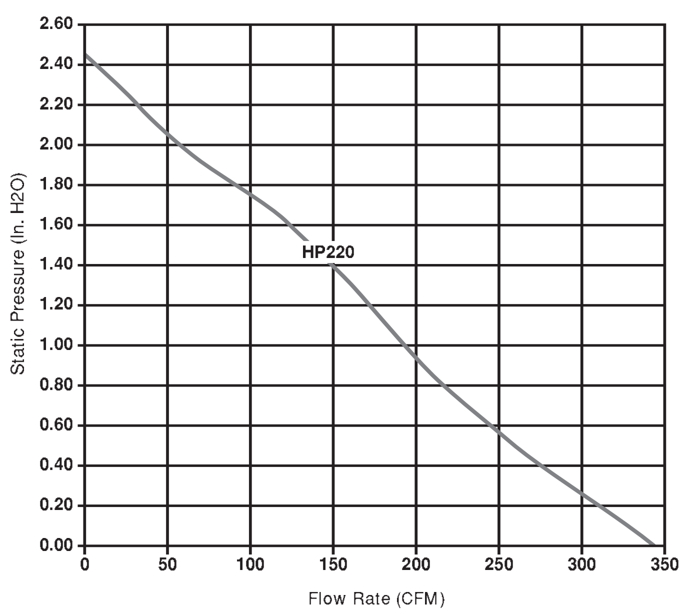
HP175 – The economical choice where slightly less air flow is needed. Often used where there is good sub slab communication and lower Radon levels.

HP190 – ***The standard for Radon Mitigation.*** Ideally tailored performance curve for a vast majority of your mitigations.

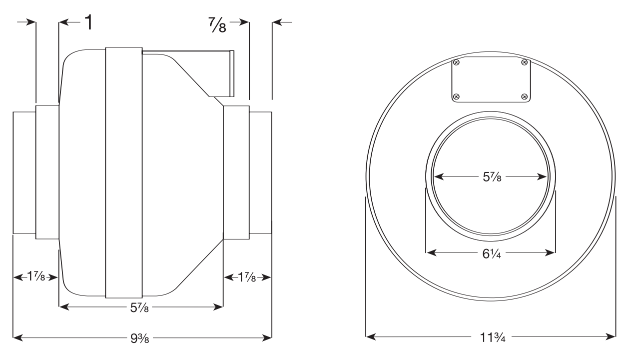
Fans are attached to PVC pipe using flexible couplings.
For 4" PVC pipe use Indiana Seals #151-44, Pipeconx PCX 51-44 or equivalent.

For 3" PVC pipe use Indiana Seals #156-43, Pipeconx PCX 56-43 or equivalent.

HP220 Radon Mitigation Fan



Tested with 6" ID duct and standard couplings.

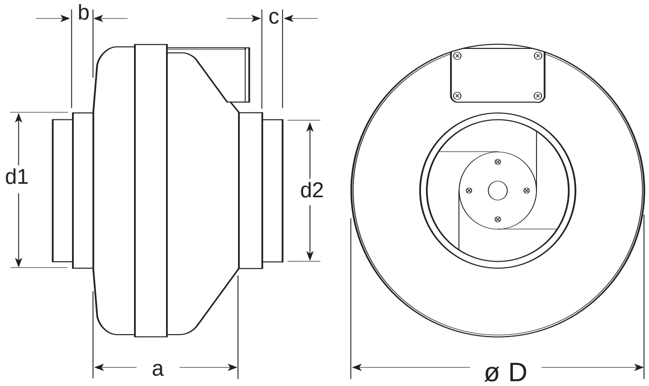


HP 220 – Excellent choice for systems with elevated radon levels, poor communication, multiple suction points and large subslab footprint. Replaces FR 175.

Fans are attached to PVC pipe using flexible couplings.
For 4" PVC pipe use Indiana Seals #156-64, Pipeconx PCX 56-64 or equivalent.

For 3" PVC pipe use Indiana Seals #156-63, Pipeconx PCX 56-63 or equivalent.

The Original Mitigator – Fantech's FR Series Fans



Dimensional Data

model	øD	d1	d2	a	b	c
FR100	9 1/2	3 7/8	4 7/8	6 1/8	7/8	7/8
FR110	9 1/2	3 7/8	4 7/8	6 1/8	7/8	7/8
FR125	9 1/2	–	4 7/8	6 1/8	7/8	–
FR140	11 3/4	5 7/8	6 1/4	5 7/8	1	7/8
FR150	11 3/4	5 7/8	6 1/4	5 7/8	1	7/8
FR160	11 3/4	5 7/8	6 1/4	6 3/8	1	7/8
FR200	13 1/4	7 7/8	9 7/8	6 1/4	1 1/2	1 1/2
FR225	13 1/4	7 7/8	9 7/8	6 1/4	1 1/2	1 1/2
FR250	13 1/4	–	9 7/8	6 1/4	–	1 1/2

All dimensions in inches

Performance Data

Fan Model	Energy Star	RPM	Volts	Rated Watts	Wattage Range	Max. Amps	CFM vs. Static Pressure in Inches W.G.							Max. Ps	Duct Dia.
							0"	.2"	.4"	.6"	.8"	1.0"	1.5"		
FR100	✓	2900	115	19	13 - 19	0.18	122	100	78	55	15	-	-	0.87"	4"
FR110	-	2900	115	80	62 - 80	0.72	167	150	133	113	88	63	41	0.60"	4"
FR125	✓	2950	115	18	15 - 18	0.18	148	120	88	47	-	-	-	0.79"	5"
FR140	✓	2850	115	61	47 - 62	0.53	214	190	162	132	99	46	-	0.15"	6"
FR150	✓	2750	120	71	54 - 72	0.67	263	230	198	167	136	106	17	1.58"	6"
FR160	-	2750	115	129	103 - 130	1.14	289	260	233	206	179	154	89	2.32"	6"
FR200	✓	2750	115	122	106 - 128	1.11	408	360	308	259	213	173	72	2.14"	8"
FR225	✓	3100	115	137	111 - 152	1.35	429	400	366	332	297	260	168	2.48"	8"
FR250*	-	2850	115	241	146 - 248	2.40	649	600	553	506	454	403	294	2.58"	10"

FR Series performance is shown with ducted outlet. Per HVI's Certified Ratings Program, charted air flow performance has been derated by a factor based on actual test results and the certified rate at .2 inches WG.
* Also available with 8" duct connection. Model FR 250-8. Special Order.

Five (5) Year Warranty

This warranty supersedes all prior warranties

DURING ENTIRE WARRANTY PERIOD:

FANTECH will replace any fan 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 fan 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.

For more information contact:

Fantech

web: www.fantech.net
e-mail: info@fantech.net

United States
1712 Northgate Blvd.
Sarasota, Florida 34234
Phone: 800-747-1762; 941-309-6000
Fax: 800-487-9915; 941-309-6099

Canada
50 Kanalflakt Way
Bouctouche, NB E4S 3M5
Phone: 800-565-3548; 506-743-9500
Fax: 877-747-8116; 506-743-9600

Distributed by:

Radon Control Inc..
567 Industrial Drive
Carmel, IN 46032

Voice: 317-846-7486
Fax: 317-846-5882

INVOICE

Invoice Number: 113184
Invoice Date: May 15, 2009
Page: 1

Duplicate

Bill To:	Ship to:
ECOSYSTEMS STRATEGIES, INC. 24 DAVIS AVE POUGHKEEPSIE, NY 12603	E-mail invoices GET JOB NAME FOR PO

Customer ID	Customer PO	Payment Terms	
ESI845	MACTEC	Net 15 Days	
Sales Rep ID	**Shipping Method**	**Ship Date**	**Due Date**
	UPS Ground	5/15/09	5/30/09

Quantity	Item	Description	Unit Price	Amount
3.00	HP220E	FANTECH 6" DUCT	145.50	436.50
6.00	B106-44	BLACK 6" TO 4" COUPL	7.15	42.90
1.00	LC-24	24" CLEAR COVER	29.50	29.50
1.00	F-S2	SUMP MODEL - BRASS	25.00	25.00
1.00	F-R2	RETROFIT FLOOR-BRASS	19.75	19.75
3.00	RC40	SCH.40 4" CAP	13.50	40.50
3.00	MU-93	MINI U-TUBE	7.75	23.25
3.00	FG-43	4" FAN GUARD	10.95	32.85
10.00	UC-40	4" METAL U CLAMP	1.50	15.00
25.00	UC-30	3.0" U CLAMP- sch 20	1.25	31.25

Subtotal	696.50
Sales Tax	
Freight	28.29
Total Invoice Amount	724.79
Payment/Credit Applied	
TOTAL	724.79

Check/Credit Memo No:

Our new catalog has been mailed. Please call for additional copies!

APPENDIX E

Operation and Maintenance Protocol

Ecosystems Strategies, Inc.
24 Davis Avenue, Poughkeepsie, NY 12603
phone 845.452.1658 | fax 845.485.7083 | ecosystemsstrategies.com

SSV SYSTEM OPERATION AND MAINTENANCE PROTOCOL

This document provides Ecosystems Strategies Inc.'s (ESI's) recommended operation and maintenance protocol for the sub-slab ventilation (SSV) system installed at the property located 608 Tompkins Lane, Village of Lindenhurst, Suffolk County, New York. This document, along with the as-built system plan should be provided, for reference, to the homeowner. It should be noted that this is ESI's recommended protocol, and that any MACTEC Environmental Engineering and Consulting, P.C. (MACTEC), and/or New York State Department of Environmental Conservation (NYSDEC) protocols established for the property, take precedence over those listed here.

Protocol:

- Inspect the SSV system fan, exterior piping, and electrical connections to ensure that all components remain affixed to the building exterior. This should occur, at a minimum, on a quarterly basis, with more frequent (monthly) inspections during the winter months (November to March) to prevent snow and ice damage.

- Inspect the u-tube manometer located on the suction piping above the suction point. The initial u-tube pressure reading was recorded as approximately 2.6 inches of water column (W.C.). The pressure reading on this gauge should remain relatively constant throughout the life of the system. Significant changes in pressure (> 0.5 W.C.) should be noted in order to determine if there may be problems with the system and/or gauge. This inspection should occur, at a minimum, on a quarterly basis. Weekly monitoring should occur if significant pressure changes are noted, in order to determine if system performance should be evaluated.

- Inspect the interior system suction piping and pipe supports to ensure the continued integrity of those components. This inspection should occur, at a minimum, on a quarterly basis.

- Inspect the slab sealing along the eastern perimeter of the garage, and the one-way floor drain valve and sealed plumbing cut-out lid in the western portion of the garage, to ensure the integrity of the seals. An inspection of the building slab should also be made for the development of any cracks or openings which may be potential vapor intrusion pathways. This inspection should occur, at a minimum, on a quarterly basis.

- Record and report any system problems to MACTEC to ensure that corrective action plans are implemented as needed.

APPENDIX F

ESI Warranty Statement

Sub-Slab Ventilation System Limited Warranty

Ecosystems Strategies, Inc. (ESI) provides a **two (2) year** limited warranty on all ESI-installed sub-slab ventilation (SSV) systems and/or ESI-installed SSV system components*****. This warranty provides coverage for defects in materials, workmanship, or design.

ESI will repair or replace any ESI-installed system components found to be defective, or alter any ESI-installed system design features found to be ineffective within the **two (2) year** warranty period free of charge.

ESI's limited SSV system warranty **does not** provide coverage for:

1) Damages caused by accidents, neglect, physical abuse, "Acts of God" (e.g., hurricanes, floods, etc.), natural shifting or settling of the building, or natural deterioration of pre-existing building materials.

2) Damages or defects in materials or workmanship for any system components not installed by ESI (i.e., any system components or system additions installed outside of ESI's installation contract by the homeowner or any other entity).

3) Decreased system effectiveness caused by Acts of God, natural shifting or settling of the building, natural deterioration of pre-existing building materials, and/or building alterations, renovations, or additions which take place after system installation.

ESI reserves the right to determine whether a warranty claim is covered under the conditions of this warranty.

This warranty is transferrable in the event of a property transaction.

[***** The SSV system fan is warranted by the manufacturer against defects or related malfunctions that may occur within five (5) years of the date of purchase. Should a problem arise with the system fan within that period, ESI will provide the proof of purchase necessary to pursue a warranty claim with the fan manufacturer.]

APPENDIX B

NYSDOH SOIL VAPOR INTRUSION FREQUENTLY ASKED QUESTIONS

NEW YORK STATE
DEPARTMENT OF HEALTH

SOIL VAPOR INTRUSION

Frequently Asked Questions

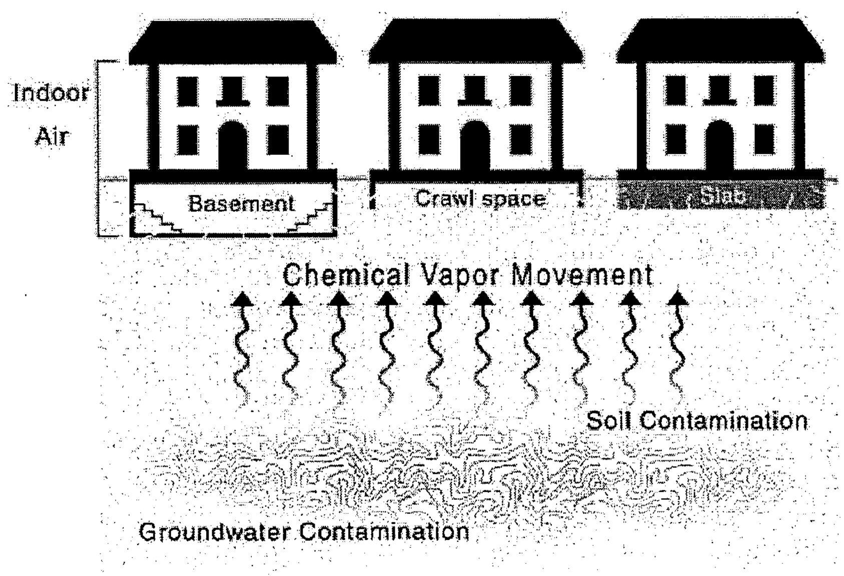
What is soil vapor intrusion?

The phrase "soil vapor intrusion" refers to the process by which volatile chemicals move from a subsurface source into the indoor air of overlying buildings.

Soil vapor, or soil gas, is the air found in the pore spaces between soil particles. Because of a difference in pressure, soil vapor enters buildings through cracks in slabs or basement floors and walls, and through openings around sump pumps or where pipes and electrical wires go through the foundation. Heating, ventilation or air-conditioning systems may create a negative pressure that can draw soil vapor into the building. This intrusion is similar to how radon gas seeps into buildings.

Soil vapor can become contaminated when chemicals evaporate from subsurface sources and enter the soil vapor. Chemicals that readily evaporate are called "volatile chemicals." Volatile chemicals include volatile organic compounds (VOCs). Subsurface sources of volatile chemicals may include contaminated soil and groundwater, or buried wastes. If soil vapor is contaminated, and enters a building as described above, indoor air quality may be affected.

When contaminated vapors are present in the zone directly next to or under the foundation of the building, vapor intrusion is possible. Soil vapor can enter a building whether it is old or new, or whether it has a basement, a crawl space, or is on a slab (as illustrated in the figure).



[Source: United States Environmental Protection Agency, Region 3]

How am I exposed to chemicals through soil vapor intrusion?

Humans can be exposed to soil vapor contaminated with volatile chemicals when vapors from beneath a building are drawn through cracks and openings in the foundation and mix with the indoor air. Inhalation is the route of exposure, or the manner in which the volatile chemicals actually enter the body, once in the indoor air.

Current exposures are when vapor intrusion is documented in an occupied building. *Potential* exposures are when volatile chemicals are present, or are accumulating, in the vapor phase beneath a building, but have not affected indoor air quality. Potential exposures also exist when there is a chance that contaminated soil vapors may move to existing buildings not currently affected or when there is a chance that new buildings can be built over existing subsurface vapor contamination. Both current and potential exposures are considered when evaluating soil vapor intrusion at a site that has documented subsurface sources of volatile chemicals.

In general, exposure to a volatile chemical does not necessarily mean that health effects will occur. Whether or not a person experiences health effects depends on several factors, including inhalation exposure, the length of exposure (short-term or acute versus long-term or chronic), the frequency of exposure, the toxicity of the volatile chemical, and the individual's sensitivity to the chemical.

What types of chemicals associated with environmental contamination may be entering my home via soil vapor intrusion?

Volatile organic compounds, or VOCs, are the most likely group of chemicals found in soil vapor, and which can move through the soil and enter buildings. Solvents used for dry cleaning, degreasing and other industrial purposes (e.g., tetrachloroethene, trichloroethene, 1,1,1-trichloroethane and Freon 113) are examples of VOCs. Examples of petroleum-related VOCs from petroleum spills are benzene, toluene, ethyl benzene, xylenes, styrene, hexane and trimethylbenzenes.

Is contaminated soil vapor the only source of volatile chemicals in my indoor air?

No. Volatile chemicals are also found in many household products. Paints, paint strippers and thinners, mineral spirits, glues, solvents, cigarette smoke, aerosol sprays, mothballs, air fresheners, new carpeting or furniture, hobby supplies, lubricants, stored fuels, refrigerants and recently dry-cleaned clothing all contain VOCs. Household products are often more of a source of VOCs in indoor air in homes than contaminated soil vapor.

Indoor air may also become affected when outdoor air containing volatile chemicals enters your home. Volatile chemicals are present in outdoor air due to their widespread use. Gasoline stations, dry cleaners, and other commercial/industrial facilities are important sources of VOCs to outdoor air.

What should I expect if soil vapor intrusion is a concern near my home?

If you live near a site that has documented soil, groundwater and/or soil vapor contaminated with volatile chemicals, you should expect that the potential for vapor intrusion is being, or has been, investigated. You may be contacted by the site owner or others working on the cleanup with information about the project. Your cooperation and consent would be requested before any testing/sampling would be done on your property. You may ask the person contacting you any questions about the work being done. You can also contact the NYSDOH's project manager for the site at 1-800-458-1158 (extension 2-7850) for additional information.

How is soil vapor intrusion investigated at sites contaminated with volatile chemicals?

The process of investigating soil vapor intrusion typically requires more than one set of samples to determine the extent of vapor contamination. Furthermore, four types of environmental samples are collected: soil vapor samples, sub-slab vapor samples, indoor air samples and outdoor air (sometimes referred to as "ambient air") samples.

<u>Soil vapor samples</u> are collected to characterize the nature and extent of vapor contamination in the soil in a given area. They are often collected before sub-slab vapor and/or indoor air samples to help identify buildings or groups of buildings that need to be sampled. Soil vapor samples are used to determine the *potential* for human exposures. *Soil vapor* samples are not the same as *soil* samples.

<u>Sub-slab vapor samples</u> are collected to characterize the nature and extent of vapor contamination in the soil immediately beneath a building with basement foundations or a slab. Sub-slab vapor results are used to determine the potential for *current* and *future* human exposures. For example, an exposure could occur in the future if cracks develop in the building's foundation or changes in the operation of the building's heating, ventilation or air-conditioning system are made that make the movement of contaminated soil vapor into the building possible.

<u>Indoor air samples</u> are collected to characterize the nature and extent of air contamination within a building. Indoor air sample results help to evaluate whether there are *current* human exposures. They are also compared to sub-slab vapor and outdoor air results to help determine where volatile chemicals may be coming from (indoor sources, outdoor sources, and/or beneath the building).

<u>Outdoor air samples</u> are collected to characterize site-specific background air conditions. Outdoor air results are used to evaluate the extent to which outdoor sources, such as automobiles, lawn mowers, oil storage tanks, gasoline stations, commercial/industrial facilities, and so forth, may be affecting indoor air quality.

What should I expect if indoor air samples are collected in my home?

You should expect the following:

- Indoor air samples are generally collected from the lowest-level space in a building, typically a basement, during the heating season. Indoor air samples may also be collected from the first floor of living space. Indoor air is believed to represent the greatest exposure potential with respect to soil vapor intrusion.
- Sub-slab vapor and outdoor air samples are usually collected at the same time as indoor air samples to help determine where volatile chemicals may be coming from (indoor sources, outdoor sources, and/or beneath the building).
- More limited sampling may be performed outside of the heating season. For example, sub-slab vapor samples without indoor air or outdoor air samples may be collected to identify buildings and areas where comprehensive sampling is needed during the heating season.
- An indoor air quality questionnaire and building inventory will be completed. The questionnaire includes a summary of the building's construction characteristics; the building's heating, ventilation and air-conditioning system operations; and potential indoor and outdoor sources of volatile chemicals. The building inventory describes products present in the building that might contain volatile chemicals. In addition, we take monitoring readings from a real-time organic vapor meter (also known as a photoionization detector or PID). The PID is an instrument that detects many VOCs in the air. When indoor air samples are collected, the PID is used to help determine whether

products containing VOCs might be contributing to levels that are detected in the indoor air.

What happens if soil vapor contamination or soil vapor intrusion is identified during investigation of a site?

Depending on the investigation results, additional sampling, monitoring or mitigation actions may be recommended. Additional sampling may be performed to determine the extent of soil vapor contamination and to verify questionable results. Monitoring (sampling on a recurring basis) is typically conducted if there is a significant potential for vapor intrusion to occur should building conditions change. Mitigation steps are taken to minimize exposures associated with soil vapor intrusion. Mitigation may include sealing cracks in the building's foundation, adjusting the building's heating, ventilation and air-conditioning system to maintain a positive pressure to prevent infiltration of subsurface vapors, or installing a sub-slab depressurization system beneath the building.

What is a sub-slab depressurization system?

A sub-slab depressurization system, much like a radon mitigation system, essentially prevents vapors beneath a slab from entering a building. A low amount of suction is applied below the foundation of the building and the vapors are vented to the outside (see illustration). The system uses minimal electricity and should not noticeably affect heating and cooling efficiency. This mitigation system also essentially prevents radon from entering a building, an added health benefit. The party responsible for cleaning up the source of the soil vapor contamination is usually responsible for paying for the installation of this system. If no responsible party is available, New York State will install the system. Once the contamination is cleaned up, the system should no longer be needed. In areas where radon is a problem, the NYSDOH recommends that these systems remain in place permanently.

What else can I do to improve my indoor air quality?

Household products and other factors, such as mold growth, carbon monoxide, and radon, can degrade the quality of air in your home. Consider the following tips to improve indoor air quality:

- Be aware of household products that contain VOCs. Do not buy more chemicals than you need at a time.
- Store unused chemicals in tightly-sealed containers in a well-ventilated location, preferably away from the living space in your home.
- Keep your home properly ventilated. Keeping it too air-tight may promote build up of chemicals in the air, as well as mold growth due to the build up of moisture.
- Fix all leaks promptly, as well as other moisture problems that encourage mold growth.
- Make sure your heating system, hot water, dryer and fireplaces are properly vented and in good condition. Have your furnace or boiler checked annually by a professional.
- Test your home for radon; take actions to reduce radon levels if needed.
- Install carbon monoxide detectors in your home; take immediate actions to reduce carbon monoxide levels if needed.

Where can I get more information?

For additional information about soil vapor intrusion, contact the NYSDOH's Bureau of Environmental Exposure Investigation at 1-800-458-1158 (extension 2-7850).

APPENDIX C

NYSDOH FACT SHEET TETRACHLOROETHENE (PERC) IN INDOOR AND OUTDOOR AIR

FACT SHEET

TETRACHLOROETHENE (PERC) IN INDOOR AND OUTDOOR AIR

MAY, 2003

This fact sheet answers a few questions about a chemical called tetrachloroethene (PERC), which is widely used to dry-clean clothes. It provides information on health effects seen in humans and animals exposed to PERC in air. It also provides information about the New York State Department of Health (NYSDOH) guideline of 100 micrograms of PERC per cubic meter of air (100 mcg/m^3) or 0.1 milligrams of PERC per cubic meter of air (0.1 mg/m^3). The fact sheet focuses on the health risks from air exposures because most of the PERC released into the environment goes into air.

Prepared by

New York State Department of Health

1. WHAT IS TETRACHLOROETHENE (PERC)?

Tetrachloroethene is a manufactured chemical that is widely used in the dry-cleaning of fabrics, including clothes. It is also used for degreasing metal parts and in manufacturing other chemicals. Tetrachloroethene is found in consumer products, including some paint and spot removers, water repellents, brake and wood cleaners, glues, and suede protectors. Other names for tetrachloroethene include PERC, tetrachloroethylene, perchloroethylene, and PCE. PERC is a commonly used name and will be used in the rest of the fact sheet.

PERC is a nonflammable, colorless liquid at room temperature. It readily evaporates into air and has an ether-like odor. Because most people stop noticing the odor of PERC in air after a short time, odor is not a reliable warning signal of PERC exposure.

2. HOW CAN I BE EXPOSED TO PERC?

People are exposed to PERC in air, water, and food. Exposure can also occur when PERC or material containing PERC (for example, soil) gets on the skin. For most people, almost all exposure is from PERC in air.

PERC gets into outdoor and indoor air by evaporation from industrial or dry-cleaning operations and from areas where chemical wastes are stored or disposed. Groundwater near these areas may become contaminated if PERC is improperly dumped or leaks into the ground. People may be exposed if they drink the contaminated water. They may also be exposed if PERC evaporates from contaminated drinking water into indoor air during cooking and washing. PERC may evaporate from contaminated groundwater and soil and into the indoor air of buildings above the contaminated area. PERC also may evaporate from dry-cleaned clothes and into indoor air or may get into indoor air after PERC-products, such as spot removers, are used. Indoor air PERC levels may get high if PERC-products are used in poorly ventilated areas.

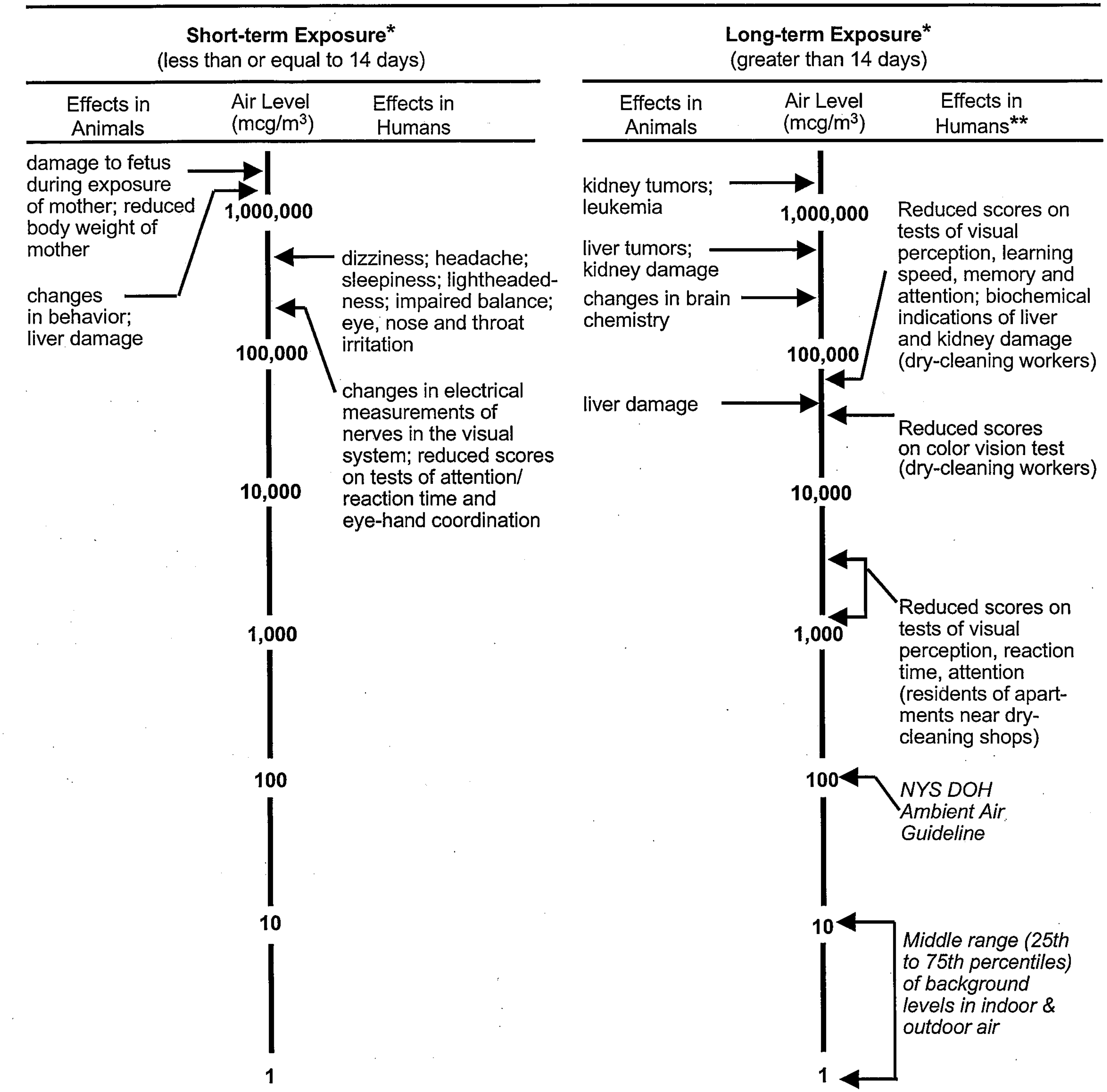
3. HOW DOES PERC ENTER AND LEAVE MY BODY?

When people breathe air containing PERC, the PERC is taken into the body through the lungs and passed into the blood, which carries it to all parts of the body. A large fraction of this PERC is breathed out, unchanged, through the lungs into the air. Some of this PERC is stored in the body (for example, in fat, liver, and brain) and some is broken down in the liver to other compounds and eliminated in urine. PERC can also be found in breastmilk. Once exposure stops, most of the PERC and its breakdown products leave the body in several days. However, it may take several weeks for all of the PERC and its breakdown products to leave the body.

4. WHAT KINDS OF HEALTH EFFECTS CAN BE CAUSED BY EXPOSURE TO PERC IN AIR?

In humans and animals, the major effects of PERC exposure are on the central nervous system, kidney, liver, and possibly the reproductive system. These effects vary with the level and length of exposure. Figure 1 shows the types of health effects seen in humans and animals and the lowest levels of PERC in air at which the effects were seen. The diagram on the right side of the figure shows the effects of long-term exposures in humans and animals whereas the diagram on the left side shows the same information for short-term exposures. Because there is a

Figure 1. Health Effects from Breathing Tetrachloroethene (PERC). The diagram shows the effects observed in humans and animals exposed to measured levels of PERC in air. The diagram contains information on the effects observed after short-term and long-term exposure. Also shown are background levels in indoor and outdoor air.



*Effects are listed at the lowest level (micrograms per cubic meter of air, mcg/m^3) at which they were first observed. They and other effects may also be seen at higher levels. 100 mcg/m^3 = 0.1 mg/m^3 (milligrams per cubic meter of air) = 15 ppb (parts per billion) = 0.015 ppm (parts per million).

**Studies have shown that workplace exposure to PERC is associated with an increased risk of cancer and spontaneous abortion, but studies did not provide good quantitative data on exposure levels.

large amount of information on the human effects of PERC, the rest of the fact sheet will discuss only the human data.

The human effects shown in Figure 1 represent the average response of a group of individuals at an estimated level of exposure (typically, the average of the measured air levels). Because data for individual people are not usually reported, some people (those sensitive to the effects of PERC) may have experienced effects at air levels below the average air level, whereas other people (those resistant to the effects of PERC) may not have experienced effects at air levels above the average air level. The difference in how people respond to the same or similar exposure levels is due, in part, to the individual differences among people. People, for example, differ in age, sex, diet, family traits, lifestyle, genetic background, the presence of other chemicals in their body (e.g., alcohol, prescription drugs), and state of health. These differences can affect how people will respond to a given exposure. One person may feel fine during and after an exposure while another person may become sick. This is known as sensitivity. Differences in sensitivity should be kept in mind when reading the following information on the human health effects of PERC.

Short-Term Exposure - Studies with volunteers show that exposures of 8-hours or less to 700,000 micrograms per cubic meter of air (mcg/m^3) cause central nervous system symptoms such as dizziness, headache, sleepiness, lightheadedness, and poor balance (Figure 1). Exposures to 350,000 mcg/m^3 for 4 hours affected the nerves of the visual system and reduced scores on certain behavioral tests (which, for example, measure the speed and accuracy of a person's response to something they see on a computer screen). These effects were mild and disappeared soon after exposure ended.

Long-Term Exposure – Numerous studies of dry-cleaning workers indicate that long-term exposure (9 to 20 years, for example) to workplace air levels averaging about 50,000 mcg/m^3 to 80,000 mcg/m^3 reduces scores on behavioral tests and causes biochemical changes in blood and urine (Figure 1). The effects were mild and hard to detect. How long these effects would last if exposure ended is not known.

One study reported reduced scores on behavioral tests in 14 healthy adults living (for 10.6 years, on average) in apartments near dry-cleaning shops. The effects were small; the average test scores of the residents were slightly lower than the average score of unexposed people. The range of measured air levels in 13 apartments was 7.6 mcg/m^3 to 23,000 mcg/m^3; one air level was below 100 mcg/m^3, five values were between 100 and 1,000 mcg/m^3, and seven values were above 1,000 mcg/m^3. The average air level in all apartments was 5,000 mcg/m^3 and the median value was about 1,400 mcg/m^3 (that is, half the measured air levels were above 1,400 mcg/m^3 and half were below it). As with the long-term occupational studies, how long these effects would last if exposure ended is not known. Confidence in the understanding of exposure in this study is less than that in the occupational studies.

Some studies show a slightly increased risk of some types of cancer and reproductive effects among workers, including dry-cleaning workers, exposed to PERC and other chemicals. Cancers associated with exposures include cancers of the esophagus, bladder, and non-Hodgkin's lymphoma. Cancers less clearly associated with exposures include cancers of the cervix, tongue, and lung. The reproductive effects associated with exposure included increased risks of spontaneous abortion, menstrual and sperm disorders, and reduced fertility. The data suggest, but do not prove, that the effects were caused by PERC and not by some other factor or factors.

Data on the workplace air levels in these studies ranged from none (reproductive studies) to some (cancer studies); however, workplace air levels during the times these studies were conducted were considerably higher than those found in indoor or outdoor air (see next question).

5. WHAT ARE BACKGROUND LEVELS FOR PERC IN INDOOR AND OUTDOOR AIR IN AREAS THAT ARE NOT NEAR A KNOWN SOURCE OF PERC?

The United States Environmental Protection Agency (US EPA) has collected and analyzed information on PERC levels in indoor and outdoor air. Table 1 contains the results from air samples collected inside and outside of buildings that were not near known sources of PERC and other chemicals (for example, a home not known to be near a chemical spill, a hazardous waste site, a dry-cleaner, or a factory). The middle half (25th to 75th percentile) of PERC levels in indoor and outdoor air samples is about 1 to 10 mcg/m^3. A similar result was found for NYS homes not near known PERC sources. NYSDOH sampled 138 homes between 1989 and 1996 and the level of PERC in the indoor air was below 10 mcg/m^3 in 95% of the homes. Collectively, these data show that background levels of PERC in air are seldom above 10 mcg/m^3.

Table 1.

Sample	PERC Air Levels (mcg/m^3)[A]			Sample Size
	25th Percentile	50th Percentile (Median)	75th Percentile	
Homes & Offices: Nationwide 1970 – 1988[B]				
Indoor	1.7	5.0	11	2,195
Outdoor	0.82	2.4	5.9	3,226
Offices: Nationwide 1994 – 1996[C]				
Indoor	not detected*	5.0	5.9	298
Outdoor		not detected*	3.0	100

[A] These databases contain air-testing results from studies where there were no known sources of chemicals or chemical spills. Outdoor samples were taken at the same time as indoor samples and at a location close to the building sampled.

[B] The US EPA Volatile Organic Compounds Database was published in March 1988.

[C] From 1994 through 1996, US EPA measured volatile organic compounds in indoor and outdoor air at 100 randomly selected public and private office buildings across the US.

* Not detected means that the amount of PERC in the air sample was less than the smallest amount of PERC that could be accurately measured (that is, the level was less than the detection limit); in these studies, the detection limit ranged from 1.4 to 2.0 mcg/m^3.

6. WHAT IS THE NEW YORK STATE DEPARTMENT OF HEALTH'S (NYSDOH) GUIDELINE FOR PERC IN AIR?

NYSDOH recommends that the average air level in a residential community not exceed 100 micrograms of PERC per cubic meter of air (100 mcg/m^3), considering continuous lifetime exposure and sensitive people. Three other ways of expressing the guideline are 0.1 milligrams per cubic meter of air (0.1 mg/m^3), 15 parts per billion (ppb) or 0.015 parts per million (ppm).

The purpose of the guideline is to help guide decisions about the nature of efforts to reduce PERC exposure. Reasonable and practical actions should be taken to reduce PERC exposure when indoor air levels are above background, even when they are below the guideline of 100 mcg/m^3. The urgency to take actions increases as indoor air levels increase, especially when air levels are above the guideline. Finally, NYSDOH recommends taking immediate action to reduce exposure when an air level is ten-times or more higher than the guideline (that is, when the air level is 1,000 mcg/m^3 or higher). In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce PERC levels in indoor air to as close to background as practical.

7. SHOULD I BE CONCERNED ABOUT HEALTH EFFECTS IF I AM EXPOSED TO AN AIR LEVEL SLIGHTLY ABOVE THE GUIDELINE?

The guideline is lower than the air levels that caused either non-cancer or cancer effects (Figure 1); thus, the possibility of health effects is low even at air levels slightly above the guideline. In addition, the guideline is based on the assumption that people are continuously exposed to PERC in air all day, every day for as long as a lifetime. This is rarely true for most people, who are more likely to be exposed for a part of the day and part of their lifetime.

8. WHEN SHOULD MY CHILDREN OR I SEE A PHYSICIAN?

If you believe you or your children have symptoms that you think are caused by PERC exposure, you and your children should see a physician. You should tell the physician about the symptoms and about when, how, and for how long you think you and/or your children were exposed to PERC.

9. WHERE CAN I GET MORE INFORMATION?

If you have any questions about the information in this fact sheet or would like to know more about PERC, please call the New York State Department of Health at 1-518-402-7800 or 1-800-458-1158 (extension 2-7800) or write to the following address.

New York State Department of Health
Bureau of Toxic Substance Assessment
Flanigan Square, 547 River Street
Troy, NY 12180-2216

APPENDIX D

NYSDOH FACT SHEET TRICHLOROETHENE (TCE) IN INDOOR AND OUTDOOR AIR

NEW YORK STATE
DEPARTMENT OF HEALTH

Trichloroethene (TCE) in Indoor and Outdoor Air

FACT SHEET
February 2005

What is trichloroethene?

Trichloroethene is a manufactured, volatile organic chemical. It has been used as a solvent to remove grease from metal. Trichloroethene has also been used as a paint stripper, adhesive solvent, as an ingredient in paints and varnishes, and in the manufacture of other organic chemicals. Other names for trichloroethene include TCE and trichloroethylene. TCE is a common name for trichloroethene and will be used for the rest of this fact sheet.

TCE is a clear, colorless liquid, and has a somewhat sweet odor. It is non-flammable at room temperature and will evaporate into the air.

How can I be exposed to TCE?

People can be exposed to TCE in air, water and food. Exposure can also occur when TCE, or material containing TCE, gets on the skin.

TCE gets into the air by evaporation when it is used. TCE can also enter air and groundwater if it is improperly disposed or leaks into the ground. People can be exposed to TCE if they drink groundwater contaminated with TCE, and if the TCE evaporates from the contaminated drinking water into indoor air during cooking and washing. They may also be exposed if TCE evaporates from the groundwater, enters soil vapor (air spaces between soil particles), and migrates through building foundations into the building's indoor air. This process is called "soil vapor intrusion."

How can TCE enter and leave my body?

If people breathe air containing TCE, some of the TCE is exhaled unchanged from the lungs and back into the air. Much of the TCE gets taken into the body through the lungs and is passed into the blood, which carries it to other parts of the body. The liver changes most of the TCE taken into the blood into other compounds, called breakdown products, which are excreted in the urine in a day or so. However, some of the TCE and its breakdown products can be stored in the fat or the liver, and it may take a few weeks for them to leave the body after exposure stops.

What kinds of health effects are caused by exposure to TCE in air?

In humans, long term exposure to workplace air containing high levels of TCE (generally greater than about 40,000 micrograms of TCE per cubic meter of air (mcg TCE/m^3)) is linked to effects on the central nervous system (reduced scores on tests evaluating motor coordination, nausea, headaches, dizziness) and irritation of the mucous membranes. Exposure to higher levels (generally greater than 300,000 mcg TCE/m^3) for short periods of time can irritate the eyes and respiratory tract, and can cause effects on the central nervous system, including dizziness, headache, sleepiness, nausea, confusion, blurred vision and fatigue. In laboratory animals, exposure to high levels of TCE has damaged the central nervous system, liver and kidneys, and adversely affected reproduction and development of offspring. Lifetime exposure to high levels of TCE has caused cancer in laboratory animals.

Some studies of people exposed for long periods of time to high levels of TCE in workplace air, or elevated levels of TCE in drinking water, show an association between exposure to TCE and increased risks for certain types of cancer, including cancers of the kidney, liver and esophagus, and non-Hodgkin's lymphoma. One study showed an association between elevated levels of TCE in drinking water and effects on fetal development. Other studies suggest an association between workplace TCE exposure and reproductive effects (alterations in sperm counts) in men. We do not know if the effects observed in these studies are due to TCE or some other possible factor (for example, exposure to other chemicals, smoking, alcohol consumption, socioeconomic status, lifestyle choices). Because all of these studies have limitations, they only suggest, but do not prove, that exposure to TCE can cause cancer in humans and can cause developmental and reproductive effects as well.

What are background levels of TCE for indoor and outdoor air?

The exact meaning of background depends on how a study selected sampling locations and conditions. Generally, sampling locations are selected to be not near known sources of volatile chemicals (for example, a home not near a chemical spill, a hazardous waste site, a dry cleaner, or a factory). In some studies, the criteria for sampling indoor air may require checking containers of volatile chemicals to make sure they are tightly closed or removing those products before samples are taken. The New York State Department of Health (NYSDOH) has used several sources of information on background levels of TCE in indoor and outdoor air. One NYSDOH study of residences heated by fuel oil found that background concentrations of TCE in indoor and outdoor air are less than 1 mcg/m^3 in most cases. In this study, most homes did not have obvious sources of volatile organic compounds (VOCs). In those homes with VOC sources, samples were taken and the data are included in the study.

What are sources of TCE in air in homes?

TCE is found in some household products, such as glues, adhesives, paint removers, spot removers, rug cleaning fluids, paints, metal cleaners and typewriter correction fluid. These and other products could be potential sources for TCE in indoor air.

Another source of TCE in indoor air is contaminated groundwater that is used for household purposes. Common use of water, such as washing dishes or clothing, showering, or bathing, can introduce TCE into indoor air through volatilization from the water.

TCE may also enter homes through vapor intrusion as described on page 1 in the question "How can I be exposed to TCE?".

What is the level of TCE that people can smell in the air?

The reported odor threshold (the air concentration at which a chemical can be smelled) for TCE in air is about 540,000 mcg TCE/m^3. At this level, most people would likely be able to start smelling TCE in air. However, odor thresholds vary from person to person. Some people may be able to detect TCE at levels lower than the reported odor threshold and some people may only detect it at concentrations higher than the reported odor threshold.

If I can't smell TCE in the air, am I being exposed?

Just because you can't smell TCE doesn't mean there is no exposure. Sampling and testing is the best way to know if TCE is present.

What is the NYSDOH's guideline for TCE in air?

After a review of the toxicological literature on TCE, the NYSDOH set a guideline of 5 mcg/m^3 for TCE in air. This level is lower than the levels that have caused health effects in animals and humans. In setting this level, the NYSDOH also considered the possibility that certain members of the population (infants, children, the elderly, and those with pre-existing health conditions) may be especially sensitive to the effects of TCE.

The guideline is not a bright line between air levels that cause health effects and those that do not. The purpose of the guideline is to help guide decisions about the nature of the efforts to reduce TCE exposure. Reasonable and practical actions should be taken to reduce TCE exposure when indoor air levels are above background, even when they are below the guideline of 5 mcg/m^3. The urgency to take actions increases as indoor air levels increase, especially when air levels are above the guideline. In all cases, the specific corrective actions to be taken depend on a case-by-case evaluation of the situation. The goal of the recommended actions is to reduce TCE levels in indoor air to as close to background as practical.

Should I be concerned about health effects if I am exposed to air levels slightly above the guideline? Below the guideline?

The possibility of health effects occurring is low even at air levels slightly above the guideline. In addition, the guideline is based on the assumption that people are continuously exposed to TCE in air all day, every day for as long as a lifetime. This is rarely true for most people who are likely to be exposed for only part of the day and part of their lifetime.

How can I limit my exposure to TCE?

TCE can get into indoor air through household sources (for example, commercial products that contain TCE), from contaminated drinking water, or by vapor intrusion. As with any indoor air contaminant, removing household sources of TCE will help reduce indoor air levels of the chemical. Maintaining adequate ventilation will also help reduce the indoor air levels of TCE. If TCE is in the indoor air as a result of vapor intrusion, a sub-slab depressurization system, much like a radon mitigation system, will reduce exposures by minimizing the movement of vapors that are beneath a slab into a building. If TCE is in the water supply of a house, a carbon filter on the water supply to remove the TCE will minimize ingestion and inhalation exposures.

Is there a medical test that can tell me whether I have been exposed to TCE?

TCE can be measured in people's breath soon after they are exposed. TCE and some of its breakdown products can be measured in the urine and blood. These tests are not routinely available at a doctor's office. Urine and blood tests can indicate that you may have recently (within the last few days) been exposed to a large amount of the chemical. However, they cannot tell you the source of the exposure. Some of the breakdown products of TCE can also be formed from other chemicals.

When should my children or I see a physician?

If you believe you or your children have symptoms that you think are caused by TCE exposure, you or your children should see a physician. You should tell the physician about the symptoms and about when, how and for how long you think you and/or your children were exposed to TCE.

What is the NYSDOH doing to educate physicians about TCE?

The NYSDOH maintains an Infoline (1-800-458-1158) that physicians or the public can call when they have questions related to various types of chemical exposures. A certified occupational and environmental health nurse is available to triage physicians' questions and to direct their inquiries to the appropriate staff member.

The NYSDOH also works closely with the federal Agency for Toxic Substances and Disease Registry (ATSDR), making their educational materials available to physicians upon request. One of these items is an environmental medicine case study entitled "Trichloroethylene (TCE) Toxicity," which provides the opportunity for physicians to earn continuing medical education credits from the Centers for Disease Control and Prevention. Physicians who would like to complete this training are encouraged to contact the NYSDOH for more information. A printed copy can be mailed to the physician or it can be accessed on-line at the following web site http://www.atsdr.cdc.gov/HEC/CSEM/tce/index.html.

Where can I get more information?

If you have any questions about the information in this fact sheet or would like to know more about TCE, please call the NYSDOH at 1-800-458-1158 or write to the following address:

New York State Department of Health
Bureau of Toxic Substance Assessment
Flanigan Square, 547 River Street
Troy, NY 12180-2216

APPENDIX F

QAPP

GENERIC QUALITY ASSURANCE PROJECT PLAN FOR WORK ASSIGNMENTS

Prepared For:

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233
Contract No. D009808

Prepared By:

HRP Associates, Inc.
1 Fairfield Square, Suite 110
Clifton Park, NY 12065

Issued On: August 8, 2019

CERTIFICATION

This Generic Quality Assurance Project Plan (QAPP) has been prepared under the supervision of, and has been reviewed by, the HRP Contract Quality Assurance Officer and the HRP Contract Manager.

HRP Contract Quality Assurance Officer: Gail L. Batchelder

Gail L. Batchelder, Ph.D., P.G., L.E.P.

HRP Contract Manager: Thom S. Seg

Thomas S. Seguljic, P.E., P.G.

LIST OF REVISIONS

Date	Summary of Changes	Approval
12/2008	Original document preparation	Jeffrey R. Sotek
8/2019	Multiple revisions throughout document	Gail L. Batchelder, Ph.D.

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Appendices

1.0 PURPOSE AND OBJECTIVES

1.1 Purpose

This Generic Quality Assurance Project Plan (QAPP) has been prepared as a generic companion document to accompany site-specific Work Plans and Field Activity Plans prepared for each standby subcontract Work Assignment issued to HRP Associates, Inc. (HRP) by the New York State Department of Environmental Conservation (NYSDEC) under Standby Contract No. D009808. The principal purpose of this document is to specify quality assurance/quality control (QA/QC) procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible. A project-specific QAPP, provided as an appendix to each project-specific Work Plan, will supplement this generic document by providing QAPP information that is specific to each site.

1.2 Quality Assurance Project Plan Objectives

The QAPP provides general information related to QA/QC procedures associated with the collection and analysis of samples of environmental media and includes specific representative standard operating procedures (SOPs) applicable to sample handling and field instrumentation use. Descriptions of field activities and SOPs associated with sample collection and field data acquisition associated with an analytical sampling program will be provided in detail in each project-specific Work Plan and the accompanying project-specific Field Activities Plan. Information provided in this generic QAPP includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; auditing; data reduction, validation, and reporting; corrective action requirements; and QA/QC reporting specific to the analyses performed by the laboratories that are used for analysis of environmental media collected under Standby Contract No. D009808. Representative laboratory information is provided, since the specific laboratory used will be selected in association with each Work Assignment.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

Each Work Assignment will be managed through an organized effort of scientific and engineering personnel and technical resources. These efforts will employ pre-approved field procedures, sampling techniques, and analytical methods to accomplish the project objectives. Effective program organization and management will permit fulfillment of these requirements by maintaining control over these activities.

2.1 Overall Project Organization and Responsibilities

The overall organizational and management plan for each Work Assignment will be presented in the project-specific Work Plan, which will include an organizational chart that illustrates the project organization and individual roles for personnel tasked with implementing the Work Plan. A Representative Organization Chart is provided with this Generic QAPP as Figure 1. The responsibilities of key project personnel are described below.

The technical management of the Work Assignments will be accomplished by the Contract Manager and the designated Project Manager and an assigned project team. Additional individuals will be made available, if warranted. The Project Manager will be responsible for developing and managing activities associated with the Work Assignment and will coordinate and direct activities identified in the project-specific Work Plan to ensure that those activities are performed in accordance with the project-specific QAPP, Work Plan, and NYSDEC requirements for the work that is performed. The Contract Manager will be responsible for overall completion of the Work Assignment in accordance with all contract requirements and Work Assignments elements and protocols.

The responsibilities of the Contract Quality Assurance (QA) Officer will include working directly with the NYSDEC Project Manager and HRP Project Manager to develop project-specific Data Quality Objectives (DQOs) for each Work Assignment and to address any project-specific changes to the generic QAPP. To maintain objectivity with respect to QA/QC auditing or decision-making, the Contract QA Officer will not be involved in the actual collection of samples and will not serve in any capacity on the project that would involve project productivity or profitability. The Contract QA Officer will act as an HRP liaison with the third-party data validator and work closely with the HRP Project Manager in QA/QC-related discussions or resolving issues with the analytical laboratory.

To facilitate adherence to the project-specific QAPP, Work Plan, and Field Activities Plan with respect to QA/QC, each Work Assignment will have an assigned Project QA Officer (generally the Contract QA Officer) to provide guidance on technical matters and review technical documents relating to the individual Work Assignment. The designated Project QA Officer will work closely with the HRP Project Manager to assess the effectiveness of the QA/QC program and recommend modifications when applicable.

The Project or Contract QA/QC Officer may delegate technical guidance or specific QA/QC activities to specially trained individuals under his/her direction. Such activities could include conducting field audits to ensure that activities performed under each Work Assignment meet technical and QA requirements as specified in the applicable project-specific documents, such as the QAPP, Work Plan, and Field Activities Plan. The Project QA Officer might also delegate preparation of project-specific data usability summary reports (DUSRs), which would subsequently be reviewed by Project QA Officer and the Contract QA Officer, depending on the project-specific requirements and the complexity of the issues identified.

HRP's Program Health and Safety Officers for each office location are also an integral part of the project implementation teams. These individuals will be responsible for the development, final technical review, and approval of the Generic Health and Safety Plan and project-specific Health and Safety Plans. In addition, they will provide authorization, if warranted, to modify personal protective equipment requirements based on field conditions. They will also provide final review of all health and safety monitoring records and personal protective equipment changes to ensure compliance with the provisions of the Health and Safety Plans.

2.2 Responsibilities for Laboratory Interaction

The HRP Project Manager or his/her designee will be responsible for directing laboratories selected for a specific Work Assignment to perform chemical analyses of environmental samples in accordance with the project-specific Work Plan. The HRP Contract QA Officer is responsible for 1) confirming that the selected laboratory is capable of providing the necessary range of analytical services in a manner that is consistent with the most recent version of the New York State Department of Environmental Conservation (NYSDEC) Analytical Service Protocol (ASP) and current United Stated Environmental Protection Agency (EPA) protocols and 2) ensuring that the selected laboratory has maintained their certification by the New York State Department of Health Environmental Laboratory Approval Program (ELAP) throughout the course of a Work Assignment.

A Laboratory Project Manager (designated by the Laboratory) will serve as the liaison between the laboratory staff and the HRP Project Manager for the Work Assignment. The laboratory is responsible for following their internal protocols for conducting QA/QC reviews of all data before those data are released to HRP, and it is the responsibility of the Laboratory Project Manager to contact the HRP Project Manager with any sample discrepancies or data concerns. The HRP Project Manager will involve the HRP Project QA Officer, as appropriate, based on the nature of the issue(s) identified.

The HRP Project QA Officer, in coordination with the HRP Project Manager, will be responsible for ensuring that laboratory QA/QC reports are provided to HRP and NYSDEC as electronic data deliverables consistent with NYSDEC requirements and electronic submission protocols, as well as in a hardcopy (such as a PDF) format. Any necessary corrective actions will be reported by the Laboratory Project Manager to the HRP Project Manager along with the QA/QC reports. The HRP Project Manager (or his/her designee), HRP QA Officer, or NYSDEC personnel may contact the laboratory directly to discuss QA concerns.

3.0 QUALITY ASSURANCE/QUALITY CONTROL OBJECTIVES FOR DATA MANAGEMENT

3.1 Introduction

This section discusses QA objectives for the environmental investigation activities at the Site. QA objectives are the requirements specifying the quality of the environmental data needed to support the decision-making process. The uncertainty must be maintained at levels that will allow the resultant data to be used for its intended purposes.

Data collected during the Work Assignments will include field measurements and laboratory analytical data. This section reviews the various types of data anticipated, and presents QA/QC objectives for data collected in conjunction with the Work Assignments.

3.2 Data Quality Objectives

Data Quality Objectives are qualitative and quantitative statements, which specify the quality of data required to support decisions. DQOs are developed to achieve the level of data quality required for anticipated data use. DQOs are implemented so that, for each task, the data are legally and scientifically defensible. The development of DQOs for a specific site takes into account a number of project-specific considerations, including: project objectives, types of data to be collected, intended use of the data, and data collection methods. These factors are used to evaluate whether the quality and quantity of data are adequate for its intended use. Sampling protocols have been developed and sampling documentation and handling procedures have been identified to result in the required data quality.

DQOs are established prior to data collection and are not considered a separate deliverable. Rather, the DQO development process is integrated with the conceptual site modeling and project planning processes, and the results are incorporated into the project-specific QAPP for the specific site location and Work Assignment. DQOs will be specified for each planned data collection activity. The DQO process results in an effective plan, which details the chosen sampling and analysis options, and the statements of confidence in decisions made during the corrective action process. Confidence statements are possible through the application of statistical techniques to the data and reference to the conceptual model that has been developed for the site.

3.3 Laboratory Quality Assurance Objectives

The fundamental mechanisms that will be employed to achieve these quality goals in laboratory analyses can be categorized as prevention, assessment, and correction. These include:

- Prevention of defects in the quality through planning and design; documented instructions and procedures; and careful selection of skilled, qualified personnel.
- Quality assessment through a program of regular audits and inspections to supplement continual informal review.
- Permanent correction of conditions adverse to quality through a closed-loop corrective action system.

Overall compliance with laboratory QC procedures will be evaluated against the criteria specified for each method. Deviations will be reported in the narrative, which contains comments or problems encountered during fractional analyses of the samples. The narrative includes the laboratory's assessment of the impact on data usability and will address QC issues related to the following:

- *Laboratory Method Performance* - QC criteria for method performance must be met for target analytes for data to be reported. These criteria generally apply to such information as instrument tune, calibration, method blanks, surrogates, and laboratory control samples.
- *Sample Matrix Effects* - QC samples are analyzed to determine measurement bias due to the sample matrix, and may include surrogates, matrix spikes, matrix spike duplicates, and laboratory duplicates. If criteria are not met, matrix interferences are confirmed either by reanalysis or by inspection of the laboratory control sample results to verify that laboratory method performance is in control. Data are reported with appropriate qualifiers or discussion.

3.4 Field Parameters and Quality Assurance Objectives

Water-quality parameters, specifically pH, conductivity, dissolved oxygen and/or oxidation/reduction potential, temperature, and turbidity (at a minimum) will be measured to provide general surface water and groundwater quality information. These parameters will also be monitored for stability during purging of groundwater monitoring wells. HRP's standard operating procedures (SOP) for field screening will be followed during field screening activities. This SOP can be found in **Appendix A**. Field methods used to measure these specific parameters will be described in detail in each of the project-specific Work Plans and Field Activity Plans.

Field screening of soil samples using a photoionization detector will be performed to assess the presence and relative concentrations of volatile organic vapors. The method for quantification of volatile organic compounds (VOCs) in soil using headspace measurement, as well as operational protocols of the photoionization detector, will be presented in the site-specific Work Plan and Field Activity Plan for each Work Assignment.

Soil vapor, indoor/outdoor air, and soil/sediment sampling locations and monitoring wells will be surveyed with the accuracy and precision requirements discussed in the project-specific Field Activity Plans. Ground surface and top-of-casing elevations for each of the newly installed monitoring wells will be measured to the nearest 0.01 foot as referenced to the North American Vertical Datum of 1988.

For field QA/QC data, specific QA objectives for each project will be determined by the HRP Project Manager in coordination with the NYSDEC Project Manager. Field QA/QC data will be maintained collected for descriptive purposes and data variability and to assist in decision-making during the performance of field activities, particularly when a dynamic work plan approach is part of the overall project work plan. The Project Manager and Project QA Officer will be responsible for reviewing and evaluating the field QC data for several purposes, including 1) recognizing whether the data collected is in accordance with project-specific DQOs and is consistent with the conceptual site model for the project and 2) recognizing anomalous or unexpected field conditions, and whether such conditions might indicate whether changes to the existing Work Plan might be necessary in a timely manner, and 3) assessing how field QC data might affect the evaluation of data usability.

Similar samples will be collected using consistent sampling methods, analyzed using consistent analytical procedures, and reported in conventional units (e.g., µg/L, µg/kg, and µg/m^3 for analytical results). Consistency in such elements is important to provide a high degree of comparability for data collected throughout the project.

3.5 Detection and Quantitation Levels

In addition, analytical sensitivity is an important component of data quality, and is evaluated using analyte detection and quantitation levels.

3.5.1 Detection Limits

A detection limit has been defined by the Committee on Environmental Improvement of the American Chemical Society (Anal. Chem. 55:2210-2218 [1983]) as "the lowest concentration that can be determined to be statistically different from a blank." Various methods are available for determining detection limits, most of which are based on the standard deviation of measurements in the region near the blank responses. The following detection limits are determined routinely in the laboratory.

Instrument Detection Limits (IDLs) are determined using the protocols given in the inorganic and organic statements of work for the EPA Contract Laboratory Program (CLP). A standard deviation is calculated from replicate measurements of a low-level standard and multiplied by 3 to give the IDL. IDLs are used as an index of instrument performance that does not include sample effects and, therefore, represent the lowest detection limit achievable. IDLs can vary between instruments of the same type and can change when re-determined.

Method Detection Limits (MDLs) are determined using the EPA procedure published in 40 Code of Federal Regulations 136 **Appendix B**. The MDL is defined as "the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte." This procedure requires that "sample processing steps of the analytical method be included in the determination of the method detection limit." Therefore, the sample matrix and sample preparation process, as well as the analytical instrumentation influence MDLs. A minimum of 7 replicate spikes at 1 to 5 times the expected MDL are analyzed. The MDL is calculated by multiplying the standard deviation of the measurements by the Student t-value for a 99 percent confidence level. Because of the wide variety of matrix types analyzed by the laboratory, MDLs are routinely determined in reagent water or standard solid matrix. These MDLs represent, therefore, the optimum values, and the MDLs for actual sample matrices are likely to be higher. MDLs can be determined for specific matrices when requested by the client.

Unless superseded by other program, project, or client requirements, IDLs and MDLs are determined annually. In addition, IDLs and MDLs are re-determined after an instrument is moved or modified, and MDLs are re-determined after a method has been significantly changed. Where more than one instrument is used in sample analyses by a given technique (e.g., gas chromatograph/mass spectrometry, gas chromatograph, graphite furnace/atomic absorption, or inductively coupled plasma), detection limit studies are performed for each instrument. A standard laboratory reporting limit is determined for each analyte based on the highest detection limit determined. Data for instruments are maintained for use in reporting data when project-specific requirements dictate lower detection limits.

A detection limit measured at a given time is an estimate of the true detection limit because the measured standard deviation used to calculate the detection limit is subject to random error and is an estimate of the population standard deviation. The confidence limits on the standard deviation and, hence the detection limit, can be determined using the chi-square (X2) distribution (40 Code of Federal Regulations 136 **Appendix B**). The 95 percent confidence limits for an MDL determined from 7 replicates are 0.64 MDL and 2.20 MDL. A re-determination of the detection limit could produce a value between the chi-square limits, even if the conditions remain the same. Day-to-day changes in instrument performance can further produce changes in the measured detection limit.

Interpreting data near detection limits can be problematic. When a measured concentration is reported as greater than the detection limit, the analyte has the specified probability of actually being present (i.e., of having a true concentration greater than zero). However, a measured concentration less than the detection limit cannot be used to draw conclusions regarding the presence or absence of an analyte in that sample. From the definition of the MDL, there is a 1 percent chance that a sample with no analyte present will be reported as a concentration greater than or equal to the MDL (false-positive). However, the probability is 50 percent that a sample with a concentration at the MDL will be measured at less than the MDL (false-negative).

3.5.2 Quantitation Levels

To ensure better precision in low-level data and to reduce the false-negative error rate, quantitation limits have been proposed as the minimum concentration at which an analyte can be quantified with an acceptable degree of confidence. The American Chemical Society Committee on Environmental Improvement has recommended that quantitation limits be calculated by multiplying 10 times the standard deviation, giving a relative standard deviation of 10 percent. The Committee further advised that quantitative interpretation, decision making, and regulatory actions should be limited to data at or above the limit of quantitation. The laboratories will use the term "Reporting Limit" for the laboratory quantitation limit.

3.5.3 Project-Specific Quality Control and Reporting Limits

The contract-required quantitation limits (CRQLs) for each Work Assignment, are the minimum levels of quantitation acceptable under the contract as listed in NYSDEC ASP 2005 Exhibit C and D, which are listed in **Appendix B**. Any project-specific revisions to these values will be addressed in the project-specific QAPP, Work Plan, and Field Activities Plan for that project.

As indicated in NYSDEC ASP (2005) Exhibit E, it is expected that the laboratories used for each Work Assignment will perform and report annual verification of MDLs by the method specified in Exhibit D (NYSDEC ASP), and that the results of the MDL study will be submitted to the NYSDEC Quality Assurance Officer. HRP will ensure that the MDLs for all samples collected each Work Assignment will meet, or be lower than, the Contract-Required Quantitation Limits (CRQLs) specified in **Appendix B** of this QAPP, unless an alternative MDL is approved by the NYSDEC Project Manager.

4.0 SAMPLE HANDLING AND CUSTODY PROCEDURES

4.1 Field Sampling Operations

The collection and subsequent laboratory analyses of environmental samples will provide the majority of the data collected during the standby contract Work Assignments. The number and types of analyses to be performed and the matrix of each of the samples are provided in each project-specific QAPP and Work Plan.

4.1.1 Sample Bottle Preparation

Chain-of-custody procedures begin with preparation of sample containers and preservatives to be used in sample collection. The standby laboratories will provide cleaned sample containers and batch-certified clean SUMMA canisters. Sample kits (coolers containing chain-of-custody forms, custody seals, sample containers, preservatives, and packing materials) will be prepared by the standby laboratories in response to receipt of the analytical task order submitted by the HRP Project Manager.

Container, preservation, and holding-time requirements for aqueous and soil samples will follow HRP's SOP for sample handling and preparation, provided in **Appendix A**. **Table 1** summarizes sampling protocols, such as container size and type, preservatives, and holding times that will generally be used during investigations conducted during Work Assignments. Project-specific sample requirements will be provided in the project-specific QAPP and Work Plan.

4.1.2 Sampling Procedures

Sampling protocols will be presented in the project-specific Work Plans and Field Activities Plans. The protocols include standard sampling procedures for sample collection, accurate sample identification, and packing of samples for shipment. Each sample container is provided with a sample label, which is filled out at the time of sample collection. During sample collection, a chain-of-custody form is initiated, which accompanies the samples during shipment to the analytical laboratory.

4.2 Laboratory Sample Receipt

Upon receipt at the laboratory, a laboratory representative inspects the samples for integrity and checks the shipment against the chain-of-custody/analytical task order form. Discrepancies are addressed at this point and documented on the chain-of-custody form and the cooler checklist. Discrepancies are reported to the Laboratory Project Manager who contacts the HRP Project Manager for resolution.

When the shipment and the chain-of-custody are in agreement, the custodian enters the samples into the Laboratory Information Management System and assigns each sample a unique laboratory number. This number is affixed to each sample bottle. The custodian then enters the sample and analysis information into the laboratory computer system.

4.2.1 Laboratory Sample Custody

The laboratory must satisfy the sample chain-of-custody requirements by implementing the following SOPs for laboratory/sample security:

- Samples are stored in a secure area
- Access to the laboratory is through a monitored area
- Visitors sign a visitor's log and are escorted while in the laboratory
- Only the designated sample custodians have keys to sample storage area(s)
- Transfers of samples in and out of storage are documented.

4.2.2 Sample Storage, Security, and Disposal

While in the laboratory, the samples and aliquots that require storage at 4°C ± 2°C are maintained in a locked refrigerator unless they are being used for analysis. The laboratory is responsible for sample storage and security to ensure that:

- Samples and extracts are stored for at least 60 days after the final analytical data report has been forwarded to the client, unless otherwise specified by DEC in coordination with the contracted laboratory. The samples, extracts, and digestates are then discarded in accordance with Occupational Safety and Health Administration guidance.
- Samples are not stored with standards or sample extracts.

5.0 CALIBRATION PROCEDURES AND FREQUENCY

Instruments and equipment used by the laboratories are controlled by a formal calibration program, which verifies that equipment is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. Instruments and equipment that measure a quantity, or whose performance is expected at a stated level, are subject to calibration. Calibration is performed using reference standards or externally by calibration agencies or equipment manufacturers. Various types of field equipment are also subject to calibration and must be calibrated in accordance with a specified program designed to ensure that each instrument is working property and the information and data obtained from the instrument will meet project-specific DQOs for the intended use of such data.

5.1 Calibration System

The following sections provide a discussion of the elements comprising the calibration system.

5.1.1 Laboratory Calibration Procedures

Written procedures are used for all instruments and equipment subject to calibration. The standby laboratories will follow NYSDEC ASP (2005) calibration procedures for laboratory equipment. Whenever possible, recognized procedures, such as those published by ASTM International or EPA, or procedures provided by manufacturers, are adopted. If established procedures are not available, a procedure is developed considering the type of equipment, stability characteristics of the equipment, required accuracy, and the effect of operational error on the quantities measured.

5.1.2 Calibration Frequency

Calibration frequency is based on the type of equipment, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended data use, specified analytical methods, effect of error upon the measurement process, and prior experience.

5.1.3 Calibration Reference Standards

Two types of reference standards will be used by the standby laboratories for calibration:

- *Physical standards*, such as weights for calibrating balances and certified thermometers for calibrating working thermometers, refrigerators and ovens, are generally used for periodic calibration.
- *Chemical standards*, such as Standard Reference Materials provided by the National Institute of Standards and Technology (NIST) or EPA. These may include vendor-certified materials traceable to NIST or EPA Standard Reference Materials. These are primarily used for operational calibration.

5.1.4 Calibration Failure

Equipment that cannot be calibrated or becomes inoperable is removed from service. Such equipment must be repaired and satisfactorily recalibrated before re-use. For laboratory equipment that fails calibration, analysis cannot proceed until appropriate corrective action is taken and the analyst achieves an acceptable calibration. This is documented in a Non-Conformance Record, which is discussed in Section 11.

Laboratory managers are responsible for development and implementation of a contingency plan for major equipment failure. The plan includes guidelines on waiting for repairs, use of other instrumentation, subcontracting analyses, and evaluating scheduled priorities.

5.2 Operational Calibration

Operational calibration is generally performed as part of the analytical procedure and refers to those operations in which instrument response (in its broadest interpretation) is related to analyte concentration. Included is the preparation of a standard response (calibration) curve and often the analysis of blanks.

5.2.1 Preparation of Calibration Curve

Preparation of a standard calibration curve is accomplished by the analysis of calibration standards, which are prepared by adding the analyte(s) of interest to the solvent that is introduced into the instrument. The concentrations of the calibration standards are chosen to cover the working range of the instrument or method. Sample measurements are made within this working range. The calibration curve is prepared by plotting or regressing the instrument responses versus the analyte concentrations. Concentrations of the analyzed samples are back-calculated from the calibration curve.

5.2.2 Blanks

Reagent and/or solvent blanks are analyzed to assess if the materials used to prepare the standards are free from interfering substances that could affect the analysis. A method blank is prepared whenever samples are processed through steps that are not applied to the calibration standards.

5.3 Periodic Calibration

Periodic calibrations are performed for equipment (e.g., balances, thermometers) that is required in the analytical method, but that is not routinely calibrated as part of the analytical procedure. The periodic calibration requirements used by the standby laboratories will be provided in **Table 2**. It should be noted that each standby laboratory may calibrate more equipment than what is presented in the table; in this instance the requirements will be included in the project-specific QAPP. Each laboratory will maintain on-site copies of all calibrations completed.

5.4 Field Equipment Calibration

The frequencies and standards used for the calibration of field equipment are provided in **Table 3**.

5.5 Calibration Records

Records are prepared and maintained for each piece of equipment (laboratory and field equipment) subject to calibration. Records demonstrating accuracy of preparation, stability, and proof of continuity of reference standards are also maintained. The standby laboratory maintains these documents on-site. Copies of the raw calibration data are kept with the analytical sample data. HRP maintains such records for field equipment used during Work Assignments in the project-specific file. A copy of the calibration records are also maintained by the HRP Field Services Department for all equipment owned by HRP.

6.0 ANALYTICAL PROCEDURES

6.1 Field Analytical Procedures

Field analytical procedures include the measurement of temperature, conductivity, dissolved oxygen, pH, turbidity, organic vapors, and groundwater levels. Site personnel will follow HRP's SOPs for field screening and sample handling and preparation. Project-specific field-measurement protocols are presented in each project-specific Work Plan and Field Activities Plan. Typical field measurement QC limits in terms of precision and accuracy are presented in **Table 4**. Changes to these typical values would be included in the project-specific QAPP, Work Plan, and Field Activities Plan.

6.2 Laboratory Analytical Procedures

Laboratory analytical requirements presented in the subsections below include a general summary of project-specific requirements related to each sample matrix to be analyzed. In accordance with NYS Public Health Law Section 502, environmental samples must be analyzed by laboratories accredited by the NYS Department of Health Environmental Laboratory Approval Program. Each analytical laboratory is responsible for maintaining internal quality controls as part of their quality assurance plan.

Concentrations of target compounds and analytes will be analyzed according to the laboratory-specific method SOPs developed for the NYSDEC ASP (2005) and EPA SW-846 Methods listed in the table below. Methods not listed in the table below are listed in the NYSDEC ASP (2005). Additional information regarding the number and types of samples to be collected at each area of concern will be presented in each project-specific Work Plan and Field Activities Plan.

Analyte List	Matrices	Method No.
EPA CLP Target Compound Lists for volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs)	Groundwater, surface water, surface and subsurface soil, sediment, and debris	EPA SW-846 Method 8260C for VOCs EPA SW-846 Method 8270D for SVOCs
EPA CLP Target Analyte List for metals	Groundwater, surface water, surface and subsurface soil, sediment, and debris	EPA Method 6010C Mercury by Cold Vapor AAS (SW-846 Method 7471A/B)
Polychlorinated biphenyls	Groundwater, surface water, surface and subsurface soil, sediment, and debris	EPA SW-846 Method 8082/A
VOCs	Air and Soil Vapor	EPA TO-15, EPA TO-14A
NOTE: Specific methods or target analyte lists that might be used for a specific project will be identified in the project-specific QAPP and project-specific Work Plan. AAS = Atomic Adsorption Spectrophotometer		

Samples will be analyzed by the laboratory within the holding times presented in each project-specific Work Plan and Field Activities Plan on a standard turnaround schedule, unless a shorter turn-around time is requested by HRP or NYSDEC.

6.3 Sample Matrices

6.3.1 Water

No laboratory filtering of groundwater samples will be performed. Analytical results for laboratory analyses will be reported in units identified in **Appendix B**.

6.3.2 Soil, Sediment and Debris

Analytical results of soil, sediment, and debris samples will be reported in terms of dry weight in the units identified in **Appendix B**.

6.3.3 Soil Vapor and Indoor/Outdoor Air

Analytical results for soil vapor and indoor/outdoor air samples will be reported in terms of volume in the units identified in **Appendix B**.

6.4 Standard Operating Procedures

The standby laboratories will maintain a manual of procedures other than laboratory-specific analytical methods in a document-controlled SOP Manual. Laboratory Method SOPs will be maintained as controlled documents in the laboratory's Methods Manuals.

6.5 Recordkeeping

The requirements for laboratory recordkeeping are provided in the laboratory's SOP Manual. Data entries are made in indelible, water-resistant ink. The date of the entry and the observer are clear on each entry. The observer uses his/her full name or initials. An initial and signature log is maintained so that the recorder of every entry can be identified. Information is recorded in a notebook or on other records at the time the observations are made. Recording information on loose pieces of paper is not allowed.

When a mistake is made, the wrong entry is crossed out with a single line initialed and dated by the person making the entry, and the correct information recorded. Obliteration of an incorrect entry or writing over it is not allowed; neither is the use of correction tape or fluid on any laboratory records.

7.0 LABORATORY AND FIELD QUALITY CONTROL CHECKS AND FREQUENCY

QC measurements for analytical protocols are designed to evaluate laboratory performance and measurement bias resulting from the sample matrix and field performance.

- *Laboratory Method Performance* - QC criteria for method performance must be met for all target analytes for data to be reported. These criteria generally apply to instrument tune, calibration, method blanks, laboratory control samples, and Standard Reference Materials.

- *Sample Performance* - The accuracy and precision of sample analyses are influenced by both internal and external factors. Internal factors are those associated with sample preparation and analysis. Internal factors are monitored by the use of laboratory QC samples. Field QC samples are analyzed to determine any measurement bias due to the sample matrix based on evaluation of matrix spikes, matrix spike duplicates, and laboratory duplicates.

- *Field Performance* - QC samples are collected to evaluate the effectiveness of the sampling program in obtaining representative samples and identifying whether cross-contamination has occurred.

7.1 Laboratory Quality Control Samples

Laboratory QC samples are included in each analysis to provide information on both method performance and sample measurement bias and are included with each analytical batch. A batch is defined as a group of field samples of similar matrix, not to exceed 20, which are processed as a unit using the same method and the same lots of standards and reagents. The laboratory QC samples discussed in the following sections are not counted in the maximum batch size of 20.

7.1.1 Method Blank

The method blank is used to monitor laboratory contamination. This is usually a sample of laboratory reagent water, or a standard solid matrix, processed through the same analytical procedure as the sample (i.e., digested, extracted, distiilled). One method blank is prepared and analyzed with each analytical batch.

7.1.2 Laboratory Control Sample

A fortified method blank is analyzed with each analysis. These samples generally consist of a standard matrix fortified with the analytes of interest for single-analyte methods and selected analytes for multi-analyte methods according to the appropriate analytical method. The analyte recovery from each is used to monitor analytical accuracy and precision.

7.1.3 Matrix Spike

A matrix spike is an aliquot of a field sample, which is fortified with the analyte(s) of interest and analyzed to monitor measurement bias associated with the sample matrix. A matrix spike and matrix spike duplicate will be performed for every laboratory analytical batch. Only matrix spikes performed on samples collected from the specific site associated with the Work Assignment can be used to evaluate matrix interference for the specific media. Use of site-specific matrix spikes and matrix spike duplicates will be identified in the project-specific QAPP, Work Plan, and Field Activities Plan.

7.1.4 Surrogates

Surrogates are organic compounds that are similar to analytes of interest in chemical composition, extraction, and chromatography, but are not normally found in environmental samples. Surrogates are added to field and QC samples in every batch. These compounds are used to monitor system performance as well as sample measurement bias. Percent recoveries are calculated for each surrogate, and evaluated against acceptance criteria.

7.2 Field Quality Control Samples

Field quality control samples are not included specifically as laboratory QC samples but are analyzed when submitted. Data for these QC samples are reported with associated samples. Often, and in accordance with project-specific DQOs, field QA/QC samples will be submitted to the laboratory with no identification that the samples submitted are QA/QC samples (i.e., submitted "blind"). In such cases, the laboratory will not be able to associate the QC samples with any specific sample location, which helps ensure that such samples are analyzed and managed in the same way as any other field sample. Such an approach provides an added level of confidence in the evaluation of results for such samples relative to the actual field samples.

7.2.1 Field Blanks

Field blanks will be collected to determine if there is cross-contamination of samples from dust, off-gassing, and/or contaminants in the air during the time when samples are being collected in the field. Field blanks will be collected at a frequency requested in the Work Assignment, and site-specific information related to the collection of field blanks will be provided in the project-specific QAPP, Work Plan, and Field Activities Plan.

The analytical laboratory will provide field blank DI water and sample jars for the collection of all field blanks. Glass jars will be used for organic blanks. The field blanks as well as the trip blanks will accompany field personnel to the sampling location.

Field blank sample bottles provided by the laboratory will be opened on-site and then resealed and place sample in a cooler and maintain a temperature of 4ºC until receipt by the laboratory.

All sample logs, labels, and chain-of-custody forms for field blank samples will be filled out and recorded in field logbook as for any other sample collected.

7.2.2 Equipment Blanks

Equipment blanks will be collected to evaluate the cleanliness of sampling equipment for soil and aqueous samples, and the potential for cross-contamination of samples due to equipment handling, decontamination and/or contaminants in the ambient air during sample collection. Equipment blanks will be collected at a minimum frequency of one per equipment type and/or media per day. Equipment blanks will not be collected in conjunction with the collection of air or vapor samples.

Equipment blanks will be collected during the course of an analytical field sampling event by pouring deionized or potable water over a particular piece of sampling equipment and into a sample container. The analytical laboratory will provide equipment blank water and sample jars with preservatives for the collection of all equipment blanks. Glass jars will be used for organic blanks. The equipment blanks, as well as the trip blanks, will accompany field personnel to the sampling location. The equipment blanks will be analyzed for the same analytes as the environmental samples being collected that day and shipped with the samples taken. In some cases, it may be acceptable to collect an equipment blank that will also serve as a field blank. Should this be determined to be appropriate for a specific project, such information will be conveyed in the project-specific QAPP, Work Plan, and Field Activity Plan.

Equipment blanks will be collected in accordance with the procedures described below:

- Decontaminate sampling device in accordance with procedures described in the applicable SOP or the project-specific Field Activity Plan.

- Pour distilled/deionized water over the sampling equipment, and collect the rinsate water in the appropriate bottles.

- Immediately place sample in a cooler and maintain a temperature of 4ºC until receipt by the laboratory.

Fill out sample log, labels, and constituents of concern forms, and record in field logbook.

7.2.3 Trip Blanks

The trip blank will be used to determine if any volatile organic cross-contamination occurs between aqueous samples during shipment. Trip blanks are only used for samples to be analyzed for volatile organic compounds (VOCs). Trip blanks will be supplied by the analytical laboratory as aliquots of distilled, deionized water that will be sealed in a sample bottle prior to initiation of each day of field work. Glass vials (40 ml) with Teflon®-lined lids will be used for trip blanks. The sealed trip blank bottles will be placed in a cooler with the empty sample bottles and shipped to the site by laboratory personnel. If multiple coolers are necessary to store and transport samples to be analyzed for VOCs, each cooler must contain an individual trip blank. Therefore, efforts will be made to include all samples to be analyzed for VOCs in a smallest number of coolers. However, if particularly contaminated samples have been collected during the same sampling event as samples expected to contain low levels of VOCs, it would be more appropriate to separate the more contaminated samples from those with lower anticipated levels of contamination. If such a situation is anticipated, the approach and applicable procedures should be described in the project-specific QAPP, Work Plan, and Field Activities Plan. Trip blanks will not be collected in conjunction with the air or soil vapor samples.

7.2.4 Field Duplicates

Field duplicates are two samples of the same matrix, often referred to as "replicate samples," that are collected, to the extent possible, from the same location at the same time using the same techniques. Field duplicates provide information on the precision of the sampling and analysis process. Field duplicates will be collected at a minimum frequency of 1 duplicate per 20 samples from each environmental media. Separate duplicate samples will be collected for the following media: surface and subsurface soil, sediment, surface water, groundwater, air, and soil vapor samples. Project-specific information on duplicate sampling will be provided in the project-specific QAPP, Work Plan, and Field Activities Plan.

7.2.5 Matrix Spike/Matrix Spike Duplicates

If determined to be necessary by the HRP's QA Officer and/or NYSDEC Project Manager, specific sampling locations/sampling intervals will be selected for collection of additional replicate samples of the environmental media that will be analyzed as matrix spike/matrix spike duplicate (MS/MSD) samples. The need for collection of MS/MSD samples and specific details regarding the collection of such samples will be identified in the project-specific QAPP and Work Plan.

7.2.6 Temperature Blanks

Laboratory will use either 1) an infrared instrument to measure the temperature of liquid samples or 2) a temperature blank will be used to measure the temperature of liquid samples. If used, temperature blanks will be supplied by the analytical laboratory. If multiple coolers are necessary to store and transport aqueous samples, then each cooler must contain an individual temperature blank (if used).

8.0 PREVENTIVE MAINTENANCE

Periodic preventive maintenance is required for all sensitive equipment. Instrument manuals will be kept on file for reference if equipment needs repair. The troubleshooting chapter of factory manuals may be used in assisting personnel in performing maintenance tasks. The frequency of preventive maintenance for field equipment is indicated in each operating instruction manual.

Field equipment is checked by field personnel under the supervision of HRP's Technical Services Group's Field Manager and/or Project Manager based on the individual's experience with the specific instrument. It is the responsibility of HRP's Technical Services Group's Field Manager or his/her qualified designee to conduct preventive maintenance. A summary of general preventative maintenance schedule is provided in **Table 5**.

Major instruments in the laboratory are covered by annual service contracts with manufacturers. Under these agreements, regular preventive maintenance visits will be made by trained service personnel. Maintenance is documented and maintained in permanent records by the individual responsible for each instrument.

Laboratory management is responsible for preparation and documentation of the laboratory's preventative maintenance program. Section Chiefs and QC Chemists implement the program, and the Quality Services Manager reviews implementation to verify compliance. For each operational group, the preventive maintenance program includes the following:

- Listing of the instruments and equipment that are included in the program
- Frequency of maintenance considering manufacturer's recommendations and/or previous experience with equipment
- For each instrument in the program, a file is maintained for the following information:
    - List of spare parts maintained by the laboratory
    - External service contracts
    - Items to be checked and/or serviced during maintenance and directions for performing maintenance (if external service is not provided of if not stated in manufacturer's instrument manuals).

9.0 QUALITY ASSURANCE PERFORMANCE AND SYSTEM AUDITS

Audits are systematic checks to determine the quality of operation of some activity or function in the field or laboratory. Field audits will be conducted to assure adherence to proper field and sampling procedures. The number of audits performed during a project will depend on the length of time over which auditable activities occur, but at least one audit will be performed during the course of a project.

Several factors will influence the number of audits that might be appropriate for a given Work Assignment. For example, for field audits, such factors would include the number of different types of field activities that are performed, the number of different field personnel conducting a specific field activity, and whether any non-conformances (and the nature of such non-conformances) have been identified during a prior audit for that project. Specific auditing of field activities that is planned for any Work Assignment will be identified in the project-specific QAPP and Work Plan. Auditing for laboratory activities will be in accordance with laboratory QA/QC and New York State Department of Health ELAP procedures.

Audits are of two types:

- *Performance audits* are independent safety and health, procedure, and/or sample checks made by a supervisor or auditor to arrive at a **quantitative** measure of the quality of the data produced by one section or the entire measurement process.

- *System audits* are on-site **qualitative** inspections and reviews of the QA system used by some part of or the entire measurement system. The audits are performed with respect to whether elements identified in the QAPP and/or Work Plan are performed properly. A checklist is typically generated from the requirements and becomes the basis for the audit. The results of any deficiencies noted during the audit are summarized in an audit report.

Laboratory performance and system audits are performed by the QA staff to assess the effectiveness of the quality system. These internal audits are performed on a routine basis. Audits are also performed by certifying agencies. Audit reports and corrective actions are available to NYSDEC for review.

9.1 Responsibility, Authority, and Timing

QA audits to be conducted for the project may include system, performance, and data audits. The Contract QA Officer will keep a tentative schedule on record that details the number and types of audits.

9.2 Field Audits

Field performance audits will be conducted on an ongoing basis during the project as field data are generated, reduced, and analyzed. All numerical manipulations, including manual calculations, will be documented. All records of numerical analyses will be legible, of reproduction quality, and sufficiently complete to permit logical reconstruction by a qualified individual other than the originator.

Indicators of the level of field performance include the analytical results of the blank and replicate samples. Each blank analysis will be considered an indirect audit of the effectiveness of measures taken in the field to ensure sample integrity (e.g., field decontamination procedures). The results of the field replicate analyses are an indirect audit of the ability of each field team to collect representative sample portions of each matrix type.

System audits of site activities will be accomplished by an assessment of all field site activities. During this audit, the auditor(s) will compare existing field practices with standard procedures, as described in the project-specific QAPP, Field Activities Plan, and Work Plan. The audit will particularly focus on whether all procedures and analyses are being conducted in accordance with procedures outlined in those documents.

Specific elements to be evaluated during the field system audit include:

- Sample documentation
- Working order of instruments and equipment
- Level of QA conducted per each field team
- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding
- Decontamination procedures
- Level of efficiency with which each team conducts planned activities at one site and proceeds to the next
- Sample packaging and shipment.

After completion of the audit, any deficiencies will be discussed with the field staff and corrections identified. If any of these deficiencies could affect the integrity of the samples being collected, the auditor(s) will inform the field staff and corrections will be implemented immediately. Field audits will be performed by the Contract QA Officer, project-specific QA Officer (if not the Contract QA Officer) and/or the Project Manager or their properly qualified designee.

9.3 Laboratory Performance and System Audits

A certified laboratory that has satisfactorily completed performance audits and performance evaluation samples in accordance with The New York State Department of Health ELAP Contract Laboratory Program will be used for all sample analysis. The results of the most recent performance audits and performance evaluations will be made available upon request.

9.4 Audit Procedures

The Contract QA Officer will ensure that a standard audit form is used for all field audits. During an audit and upon its completion, the auditor(s) will discuss the findings with the individuals audited and discuss and agree on corrective actions to be initiated. The auditor will then prepare and submit an audit report to the manager of the audited group, the Project Manager, the Project QA Officer(if applicable), and the Contract QA Officer.

The manager of the audited group will then prepare and submit, to the Contract QA Officer and the Project Manager (and project QA Officer, if applicable), a plan for implementing the corrective action to be taken on non-conformances indicated in the audit report, the date by which such corrective action will be completed, and actions taken to prevent reoccurrence. If the corrective action has been completed, supporting documentation should be attached to the reply. The auditor will ascertain (by re-audit or other means) if appropriate and timely corrective action has been implemented.

Records of audits will be maintained in the project files.

9.5 Documentation

To ensure that the previously defined scope of the individual audits is accomplished and that the audits follow established procedures, a checklist will be completed during each audit. The checklist will detail the activities to be executed and ensure that the auditing plan is accurate. Audit checklists will be prepared in advance and will be available for review. Following each system, performance, and data audit, the Quality Services Manager (for laboratories) or the Project QA Officer (for field audits) will prepare a report to document the findings of the specific audit.

10.0 DATA REDUCTION, VERIFICATION, VALIDATION, AND REPORTING

10.1 Data Reduction

10.1.1 Field and Technical Data Reduction

Field personnel will record all field data in bound field logbooks and on standard forms. After checking the validity of the data in the field notes, the Project Manager and/or General Supervisor or his/her designee will reduce the data to tabular form, when possible, by entering the data into an electronic database. Where appropriate, the data files will be set up for direct input into the electronic project database. Subjective data will be filed as hard copies for later review by the Project Manager and appropriate members of the project team and incorporation into technical reports, as appropriate.

10.1.2 Laboratory Data Reduction

Data reduction is the process by which raw analytical data generated from laboratory instrument systems is converted into usable concentrations. The raw data, which may take the form of area counts, instrument responses, or observations, are processed by the laboratory and converted into concentrations expressed in appropriate units for the specific analyte or analytical group. Raw data from these systems include compound identifications, concentrations, retention times, and data system print-outs. Raw data are usually reported in graphic form, bar graph form, or tabular form. The laboratory will follow standard operating procedures consistent with the data handling requirements of the applicable methods.

The laboratory reporting limits for each project must be less than or equal to those stipulated for each Work Assignment. Contract-required quantitation limits are presented in **Appendix B** of this QAPP.

10.2 Data Verification

10.2.1 Field and Technical Data Verification

Verification of objective field and technical data will be performed at different levels and at different stages of the project. The first level of data verification will be performed at the time of collection by following standard procedures and QC checks. Field work sheets will be reviewed by the Project Manager or his/her designee for completeness and accuracy for each project within one to days of each day of field work. The Project Manager or designee will make any necessary inquiries with field personnel regarding missing information or data or suspected inconsistencies or errors in the field reports within one to two days of identifying such issues and will follow up to ensure that any necessary corrections or changes have been made, not just to the field reports themselves, but also with respect to any necessary changes that might be necessary to the field program based on identified issues.

Final review of field work sheets will be conducted following completion of the field sampling activities and prior to placement of the work sheets into the project file. The work sheets, including any necessary corrections, will be included in the final project report.

Auditing of field activities by the Project Manager, Project QA Officer, or a qualified designee will provide random checks of sampling and field conditions as the field activities are occurring. Once field data has been organized and, as appropriate, entered into an electronic database, the Project Manager or designee will then review the data to ensure that the correct codes and units have been included and will review data sets for anomalous values and other issues that might affect the quality of the field data generated for the project. This task will generally be conducted as soon as possible after data has been organized into tables, graphs, and/or figures, with the objective of reviewing the data within a time-frame that will permit additional data collection, if necessary, to obtain a dataset that will meet the project-specific DQOs.

10.2.2 Analytical Data Validation

If a Work Assignment requires the validation of data, formal data validation will be performed to establish the quality for all analytical data that will be used when making project decisions. Laboratories will submit results that are supported by sufficient back-up data and QA/QC results to enable the reviewer to conclusively determine the quality of the data. The laboratory will review data prior to its release from the custody of the laboratory. The laboratory is required to evaluate and confirm their ability to meet the objectives for data quality (data quality objectives) established for each project and identified in each project-specific QAPP, Work Plan, and/or FAP. Outlying data will be flagged in accordance with laboratory standard operating procedures, and corrective action will be taken to rectify the problem.

The purpose of data validation is to identify and document the quality of the analytical data generated by the laboratory, as all data used for decision-making purposes must be of known and acceptable quality for the intended use of the data. The person performing the data validation effort must be independent of the laboratory that generated the data. When full data validation is deemed necessary by the NYSDEC project manager, a NYSDEC-approved, qualified, independent third-party data validator, as described in the Schedule 1 of the Standby Contract D009808 (Attachment 1) will review the data package to determine completeness and compliance in accordance with that document.

A narrative describing how the data did or did not meet the validation criteria is part of the data validation procedure. The validation assessment will describe the overall quality of the data and the data validation report will provide a written statement upon completion of the validation indicating whether or not the data are valid and usable and will include a percent completeness value of usable data, and a spreadsheet that summarizes the results of the data validation effort. The data validation report will be reviewed by the QA Officer.

10.2.3 Data Usability Summary Report

For all data generated during Work Assignments, a Data Usability Summary Report (DUSR) will be prepared to provide a thorough evaluation of analytical data without third-party data validation. The primary objective of a DUSR is to determine whether the data, as presented, meet the project-specific criteria for data quality and usability, as indicated in the project-specific data quality objectives established in the project-specific QAPP, Work, and FAP. The DUSR will be prepared by a NYSDEC-approved qualified environmental scientist in accordance with Schedule 1 of the Standby Contract D009808 and will be reviewed by the QA Officer.

10.3 Reporting

10.3.1 Field Measurements

Any field analysis results will be recorded in a dedicated field logbook at the time the results are available. The field logbook will be reviewed by the General Supervisor and/or the Project Manager for completeness and accuracy within one to two days. The General Supervisor and/or the Project Manager will make any necessary inquiries with Field Personnel regarding missing information or data or suspected inconsistencies or errors in the field reports within one to two days of identifying such issues and will follow up to ensure that any necessary corrections or changes have been made, not just to the field reports themselves, but also with respect to any necessary changes that might be necessary to the field program based on identified issues. Final review of field work sheets will be conducted following completion of the field sampling activities and prior to placement of the work sheets into the project file.

The results will be tabulated and plotted in the office as part of the reporting tasks. Reports also will consist of the field logbook, required field data forms and work sheets, photographic documentation, and daily QC reports, as applicable. The work sheets, including any necessary corrections, will be included in the final project report.

10.3.2 Analytical Data

The content of analytical laboratory data packages designed for work conducted in association with each Work Assignment are site-specific and will include the following information:

- Pertinent physical data presented in concise, easy to follow formats (i.e., sample number, client, date of sample preparation, date analyzed, percent moisture, etc.)
- Reference for the analytical methodology used
- General discussion including a description of sample types, tests performed, any problems encountered, and general comments
- Data from each discrete sample, including all pertinent dates, information, and reporting limits
- Data for associated QC samples such as blanks, spikes and spike duplicates, laboratory duplicates, field duplicates, and appropriate check standards. (In some cases, field QC samples will not be provided as such to the laboratory, instead being submitted to the laboratory in a "blind" manner so the laboratory is not alerted to the fact that specific samples are actually QC samples.)
- Copies of chain-of-custody sheets
- Raw data.

11.0 CORRECTIVE ACTION PROCEDURES

11.1 Objectives

The objectives of the corrective action procedures presented below are to ensure that recognized errors in performance of sample and data acquisition lead to effective remedial measures and that those steps are documented to provide assurance that any data quality deficiencies are recognized in later interpretation and taken into account during the evaluation of data usability. The overall objective of corrective action procedures is to ensure that the activity that required corrective action does not recur.

11.2 Rationale

Many times corrective measures are undertaken in a timely and effective fashion but go undocumented. In other cases, corrective actions are of a complex nature and may require scheduled interactions between departmental groups. In either case, documentation in a formal or informal sense can reinforce the effectiveness and duration of the corrective measures taken.

11.3 Corrective Action Methods

11.3.1 Corrective Action Steps

Immediate corrective actions are of a minor or routine nature such as correcting malfunctioning equipment, correction of data transcription errors, and other such activities routinely made in the field, laboratory, or office by technicians, analysts, and other project staff.

11.3.2 Long-Term Corrective Actions

Long-term corrective action will be used to identify and eliminate causes of non-conformances which are of a complex nature and that are formally reported between management groups.

11.3.3 Corrective Action Steps

For long-term corrective actions, steps comprising closed-loop corrective action system are as follows:

- Define the problem
- Assign responsibility for investigating the problem
- Investigate and determine the cause of the problem
- Determine a corrective action to eliminate the problem
- Assign and accept responsibility for implementing the corrective action
- Verify that the corrective action has eliminated the problem.

11.3.4 Audit-Based Non-Conformances

Following audits, corrective action is initiated by documenting the audit finding and recommended corrective action on an Audit Finding Report.

11.4 Corrective Action Report Review and Filing

Immediate and long-term corrective actions require review to assure that, during the time of non-conformance, erroneous data were not generated or that, if possible, correct data were acquired instead. Such initial confirmation and review is the responsibility of the supervisor of the staff implementing the corrective action. Confirmation will be acknowledged by notation and dated signature on the affected data record or appropriate form or by memorandum to the Project Manager, Project QA Officer (if applicable), and Contract QA Officer. Such notification of the initial issue and corrective action must be made in a sufficient time-frame that any necessary additional actions can be taken to ensure the collection of data that meets the project-specific DQOs.

11.5 Corrective Action Reports to Management

The Contract Manager will be informed verbally of non-conformance events as soon as possible, and decisions made after evaluation is documented in the Non-Conformance Records. The Contract QA Officer will provide the Contract Manager with corrective action reports in a timely manner. A copy of each Non-Conformance Record is maintained in the report.

12.0 QUALITY ASSURANCE REPORTS

Fundamental to the success of the QA/QC effort is the active participation of the Project Manager, General Supervisor, Project QA Officer (when that role is fulfilled by someone other than the Contract QA Officer), and the Contract QA Officer. The Contract QA Officer will be advised of project activities and will participate in development, review, and operation of the project. Project management will be informed of QA activities through the receipt, review, and/or approval of:

- Project- or task-specific work plans and QAPPs
- Corporate and project-/task-specific QA/QC plans and procedures
- Corrective action notices
- Non-conformance records.

Periodic assessment of field and laboratory QA/QC activities and data accuracy, precision, and completeness will be conducted and reported by the Contract QA Officer and the laboratory Quality Services Manager, as appropriate relative to the specific activity. Items to be included in the QA reports are the summary of results for the performance or the system audit and, where applicable:

- Assessment of adherence to work scope and schedule for the audited task
- Assessment of the precision, accuracy, and completeness of sample batches and subsequent status of data processing and analyses
- Significant QC problems and the status of any ongoing corrective actions
- Changes to the project-specific Work Plan, Field Activities Plan, and or QAPP
- Status of implementation of the project-specific Work Plan, Field Activities Plan, and or QAPP.

13.0 REFERENCES

New York State Department of Environmental Conservation (NYSDEC). 2010. *DER-10, Technical Guidance for Site Investigation and Remediation*, Division of Environmental Remediation. May 2010.

NYSDEC. 2005. Analytical Service Protocol, July 2005.

NYSDEC, Technical Procedure Guidance, Quality Assurance/Quality Control Procedures, *Spill Guidance Manual*, Section 2.4.

NYSDEC, Technical Procedural Guidance, Equipment Training, Calibration, and Maintenance, *Spill Guidance Manual*, Section 2.2.

U.S. Environmental Protection Agency (USEPA). 2019. *Test Methods for Evaluating Solid Waste, Laboratory Manual Physical/Chemical Methods*, Office of Solid Waste and Emergency Response, SW-846, through Update VI, Phase III.

USEPA. 2017. *Standard Operating Procedure Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction potential [ORP], and turbidity)*, USEPA, Region 1, Quality Assurance Unit, Revision Number 3, Revised March 23, 2017.

USEPA. 2004. *Guidance for Development of Quality Assurance Project Plans for Environmental Monitoring Projects*, USEPA Region 2, Division of Environmental Science and Assessment, April 12, 2004.

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TABLE 1

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING-TIME REQUIREMENTS

Soil

Parameter	Matrix	Number of Samples (including Field QC)	Preparation Method	Analytical Method*	Containers per Sample			Preservation Requirements			Maximum Holding Time
					No.	Size	Type	Temp.	Light Sensitive	Chemical	
VOCs by GC/MS	Soil/Sediment	Provided in project-specific QAPP	5035A	SW-846 Method 8260B	3 vials 1 jar	40 ml vials, any size jar	glass vials clear glass jar	2-6º C	No	MeOH/ Sodium bisulfate/deionized water/freezing	14 days * *
SVOCs by GC/MS	Soil/Sediment	Provided in project-specific QAPP	3546	SW-846 Method 8270C	1	8 oz	amber glass jar	2-6º C	Yes	NA	14 days
Trace metals by ICP-AES	Soil/Sediment	Provided in project-specific QAPP	3050B	SW-846 Method 6010B	1	8 oz	clear glass jar	NA	No	NA	6 months
Mercury by Cold Vapor AAS	Soil/Sediment	Provided in project-specific QAPP Addendum	Inc. in 7471A method	SW-846 Method 7471A	1	8 oz	clear glass jar	NA	No	NA	28 days
Trace Metals by AAS and Direct Aspiration	Soil/Sediment	Provided in project-specific QAPP	3050B	SW-846 Method 7000 series	1	8 oz	clear glass jar	NA	No	NA	6 months
PCBs by GC	Soil/Sediment	Provided in project-specific QAPP	3546	SW-846 Method 8082	1	8 oz	clear glass jar	2-6º C	No	NA	14 days
Chlorinated Pesticides by GC	Soil/Sediment	Provided in project-specific QAPP	3546	SW-846 Method 8081A	1	8 oz	clear glass jar	2-6º C	No	NA	14 days
Total and Physiologically Available Cyanide	Soil/Sediment	Provided in project-specific QAPP	Inc. in 9014 method	Modified SW-846 Method 9014	1	8 oz	plastic jar	2-6º C	No	NA	14 days
Colorimetric Hexavalent Chromium	Soil/Sediment	Provided in project-specific QAPP	3060A	SW-846 Method 7196A	1	8 oz	clear glass jar	2-6º C	No	NA	30 days
Total Petroleum Hydrocarbons	Soil/Sediment	Provided in project-specific QAPP	3646	SW-846 Method 8100	1	8 oz	clear glass jar	2-6º C	No	NA	14 days
TPH	Soil/Sediment	Provided in project-specific QAPP	3546	SW-846 Methods 8015M/8015B/8100	1	8 oz	clear glass jar	2-6º C	No	NA	14 days
TCLP 1311	Soil/Sediment	Provided in project-specific QAPP	NA	SW-846 Method 1311	1	8 oz	analysis specific see method	NA	NA	NA	NA
SPLP 1312	Soil/Sediment	Provided in project-specific QAPP	NA	SW-846 Method 1312	1	8 oz	analysis specific see method	NA	NA	NA	NA

TABLE 1

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIME REQUIREMENTS (Continued)

Groundwater

					Containers per Sample			Preservation Requirements			
Parameter	**Matrix**	**Number of Samples (including Field QC)**	**Preparation Method**	**Analytical Method***	**No.**	**Size**	**Type**	**Temp.**	**Light Sensitive**	**Chemical**	**Maximum Holding Time**
VOCs by GC/MS	Aqueous	Provided in project-specific QAPP	5035	SW-846 Method 8260B	2	40 ml	glass vial	2-6º C	No	HCL	14 days
SVOCs by GC/MS	Aqueous	Provided in project-specific QAPP	3510C	SW-846 Method 8270C	2	1 liter	amber bottle	2-6º C	Yes	NA	7 days
Trace metals by ICP-AES	Aqueous	Provided in project-specific QAPP	3005A	SW-846 Method 6010B	1	250 ml	plastic bottle	NA	No	Nitric Acid	6 months
Mercury by Cold Vapor AAS	Aqueous	Provided in project-specific QAPP	Inc. in 7470 method	SW-846 Method 7470A	1	250 ml	plastic bottle	NA	No	Nitric Acid	28 days
Trace Metals by AAS and GF	Aqueous	Provided in project-specific QAPP	3050B	SW-846 Method 7000 series	1	250 ml	plastic	NA	No	Nitric Acid	6 months
Trace Metals by AAS and Direct Aspiration	Aqueous	Provided in project-specific QAPP	3005A	SW-846 Method 7000 series	1	250 ml	plastic	NA	No	Nitric Acid	6 months
ETPH	Aqueous	Provided in project-specific QAPP	3510C	CT ETPH	1	1 liter	amber bottle	2-6º C	Yes	NA	7 days
PCBs by GC	Aqueous	Provided in project-specific QAPP	3510C	SW-846 Method 8082	2	liter	clear glass bottle	2-6º C	No	NA	7 days
Chlorinated Pesticides by GC	Aqueous	Provided in project-specific QAPP	3510C	SW-846 Method 8081	2	liters	clear glass bottle	2-6º C	No	NA	7 days
Total and Physiologically Available Cyanide	Aqueous	Provided in project-specific QAPP	Inc. in 9014 method	Modified SW-846 Method 9014	1	250 ml	plastic bottle	2-6º C	No	NaOH	14 days
Colorimetric Hexavalent Chromium	Aqueous	Provided in project-specific QAPP	Inc. in 7196 method	SW-846 Method 7196A	1	250 ml	plastic bottle	2-6º C	No	NA	24 hours
EDB and DBCP	Aqueous	Provided in project-specific QAPP	Inc. in 504.1 method	EPA Method 504.1	2	40 ml	vials	2-6º C	No	Sodium Thiosulfate	14 days
VOCs by GC/MS	Aqueous	Provided in project-specific QAPP	Inc. in 624 method	EPA Method 624	2	40 ml	vials	2-6º C	No	HCL * * *	14 days
ICP-MS	Aqueous	Provided in project-specific QAPP	3005A	EPA Method 6020A	1	250 ml	plastic bottle	NA	No	Nitric Acid	6 months
200.7	Aqueous	Provided in project-specific QAPP	3005A	EPA Method 200.7	1	250 ml	plastic bottle	NA	No	Nitric Acid	6 months
TPH	Aqueous	Provided in project-specific QAPP	3510C	SW-846 Method 8015M/8015B/8100	1	1 liter	amber bottle	2-6º C	No	NA	7 days
Total Hardness	Aqueous	Provided in project-specific QAPP	NA	EPA 130.2	1	250 ml	plastic bottle	2-6º C	No	NA	6 months
Reactivity	Aqueous	Provided in project-specific QAPP	NA	Sulfide=7332930A, Cyanide=SW9014	1	500 ml	plastic bottle	2-6º C	No	NA	14 days
Conductivity	Aqueous	Provided in project-specific QAPP	NA	EPA Method 2510B	1	250 ml	plastic bottle	2-6º C	No	NA	28 days
Flashpoint	Aqueous	Provided in project-specific QAPP	NA	SW-846 Method 1010	1	flashpoint bottle	amber, small neck	2-6º C	Yes	NA	asap
Sulfide	Aqueous	Provided in project-specific QAPP	NA	SN4500S2E	1	250 ml	plastic bottle	2-6º C	no	0.43 ml Zn acetate & 0.50 ml NaOH	7 days
Chloride	Aqueous	Provided in project-specific QAPP	NA	SM4500CLB	1	250 ml	plastic bottle	2-6º C	no	NA	28 days

TABLE 1

SAMPLE CONTAINERS, PRESERVATION, AND HOLDING TIME REQUIREMENTS (Continued)

Soil Gas

Parameter	Matrix	Number of Samples (including Field QC)	Preparation Method	Analytical Method*	Containers per Sample			Preservation Requirements			Maximum Holding Time
					No.	Size	Type	Temp.	Light Sensitive	Chemical	
TO-15	Air	Provided in project-specific QAPP	NA	EPA TO-15	1	3-Liter, 6-Liter	Summa Canister, Tedlar Bag	NA	No	NA	30 Days (Summa Canister), 48 hours (Tedlar Bag)

* Analytical Methods in accordance with NYSDEC ASP 2005.
* * VOC soil/sediment samples can be frozen. If this option is selected, the sample must be frozen within 48 hours of collection. The holding time recommences when thawing begins. The total holding time is calculated to freezing plus the time allowed for thawing. The total elapsed time must be less than 14 days.
* * * Sodium bisulfate preservation can lead to formation of acetone in samples containing high amount of humic material, and certain analytes, such as styrene, vinyl chloride, trichloroethene (TCE), may be decomposed by the bisulfate, leading to low- biased results. For carbonate rich soils effervescence may occur, which would result in significant losses of VOCs. In such cases, the sodium bisulfate cannot be used as a preservation method. Although use of this preservation technique is discouraged unless the limiting factors are known not to be present, preservation for low-concentration samples may be an acceptable option as long as the limitations are considered on a site-specific basis.

Acronym List:

AAS: Atomic Absorption Spectrometer
AES: Atomic Emission Spectrometry
GC: Gas Chromatography
GF: Graphite Furnace
HCL: Hydrochloric Acid
HPLC: High Performance Liquid Chromatography
ICP: Inductively Coupled Plasma
MeOH: Methanol
MS: Mass Spectrometry
N/A: Not Applicable
NaOH: Sodium Hydroxide
PCBs: Polychlorinated Biphenyls
VOCs: Volatile Organic Compounds

TABLE 2

SUMMARY OF PERIODIC LABORATORY CALIBRATION REQUIREMENTS

Instrument	Calibration Frequency	Acceptance Limits	Corrective Actions
Analytical Balances	Daily: Sensitivity (with a Class P weight)	0.001 g	Adjust sensitivity
	Monthly: Checked with Class S Weights	Standard deviation of <0.1 mg	Service balance
	Annually: Calibrated by outside vendor against certified Class S weights	0.001 g	Service balance
Thermometers	Annually: Calibrated against certified National Institute of Standards and Technology thermometers by outside vendor	± 0.5°C	Tag and remove from service
Automatic Pipettors	Quarterly: Gravimetric check	High volume (>100 mL): d1.0% relative error as relative standard deviation	Service or replace
		Low volume (<100 mL): d2.0% relative error as relative standard deviation	

TABLE 3

FIELD INSTRUMENTATION CALIBRATION FREQUENCY

Instrument	Frequency of Calibration Check	Calibration Standard
pH Meter	Prior to use – daily, and as needed in the field	Commercially prepared pH buffer solutions (4.01, 7.00, 10.00)
Conductivity Meter	Prior to use – daily, and as needed in the field	Commercially prepared saline solution (12.9 mS/cm)
Water-level Meter	Prior to initiating field work	100-ft engineer's tape
Dissolved Oxygen Meter	Per sampling event, and as needed in the field	Saturation
Photoionization Detector	Prior to use – daily, and as needed in the field	100 ppm isobutylene
Turbidity	Prior to use – daily, and as needed in the field	10 NTU, 200 NTU

Note: mS/cm = millisiemens per centimeter ppm = parts per million
NTU = Nephelometric Turbidity Units

TABLE 4

FIELD MEASUREMENT QUALITY CONTROL OBJECTIVES

Field Parameter	Precision	Accuracy
Water Temperature	± 1°C	± 1°C (instrument capability)
pH	± 0.1 pH Standard Unit	± 0.1 pH Standard Unit (instrument capability)
Conductivity	± 1 mS/cm	±5% standard
Dissolved Oxygen	± 0.02 mg/L	±5%
Turbidity	± 1.0 NTU	±2% standard
Water Level	± 0.01 foot	±0.01 foot

Note: Precision units presented in applicable significant figures.
mS/cm = millisSiemens per centimeter
ppm = parts per million
mg/L = mg/liter
NTU = Nephelometric Turbidity Units

TABLE 5

PREVENTATIVE MAINTENANCE SUMMARY

Maintenance	Frequency
Conductivity, pH, Dissolved Oxygen Meters	
Store in protective casing	D
Inspect equipment before and after use	D
Clean probes	D
Keep logbook in instrument	D
Have replacement meter available	D
Replace probes	X
Return to manufacturer for service	X
Calibration	D
Turbidity Meter	
Store in protective casing	D
Inspect equipment before and after use	D
Clean sample cells	D and X
Clean lens	M and X
Check and recharge batteries	D
Keep logbook in instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D
Thermometer	
Store in protective casing	D
Inspect equipment before and after use	D
Have replacement thermometer available	D
Water-level Meter	
Store in protective covering	D
Inspect equipment before and after use	D
Check indicators/batteries	D
Keep logbook on instrument	D
Have replacement meter available	D
Photoionization Detector	
Store in protective casing	D
Inspect equipment before and after use	D
Check and recharge batteries	D
Clean ultraviolet lamp and ion chamber	M and X
Keep logbook in instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D

Note: D = Daily. M = Monthly. X = Operator's discretion/as needed.

APPENDIX A
STANDARD OPERATING PROCEDURES for SAMPLE HANDLING and FIELD SCREENING

HRP Associates, Inc.

STANDARD OPERATING PROCEDURE
for

Sample Handling

SOP #106

Revision Date: August 8, 2019

LIST OF REVISIONS

Date	Summary of Changes	Approval
	Original document preparation	
8/2019	Multiple revisions throughout document	Gail L. Batchelder, Ph.D.

Reviewed by:

Technical Director/
Quality Assurance Officer

Gail L. Batchelder, Ph.D., P.G., L.E.P.

August 8, 2019
Date

Vice President/
Practice Leader - Environmental:

Scot Kuhn, P.G., L.E.P.

August 8, 2019
Date

TABLE OF CONTENTS

ATTACHMENT

1.0 INTRODUCTION

This SOP identifies the containers, preservatives, sample preparation, chain-of-custody procedures, and QA/QC procedures associated with the various types of samples collected and analyzed by HRP.

Equipment: This SOP deals primarily with methods requiring no equipment other than sample containers.

Documentation: Field notebook and map or field work sheets to detail location of sampling points and relevant information related to sample collection.

Chain-of-custody form for each sample delivery group.

2.0 CONTAINERS

2.1 Soils and Unconsolidated Materials

Samples of soil and other unconsolidated materials will be collected into wide-mouth glass jars with tightly fitting lids, or other appropriate container based on the analyses to be conducted. Specific information related to the appropriate container can be found in the project-specific Quality Assurance Project Plan (QAPP) and/or work plan. Sample containers to be submitted directly to the laboratory should be filled to the extent possible to eliminate any headspace and to ensure that sufficient sample is available for all analyses to be performed, although filling the jar completely is not required if that amount of soil is not needed to accomplish the project objectives for analyses to be performed.

However, for those samples for which analysis for volatile organic compounds (VOCs) will be conducted, EPA Method 5035A methods for sample collection and preservation will be used. Those methods are described in detail in HRP SOP #105 *Soil Sample Collection for VOC Analysis*. For such samples, 40-milliliter (ml) vials are obtained in advance from the laboratory filled with the appropriate amount of methanol and/or sodium bisulfate, and the vials are filled with the appropriate amount of soil specified by the SOP or the laboratory (if different).

2.2 Liquids

Several types of containers are available for liquid samples. The type(s) of container to be used are determined by the analyses to be performed and the nature and chemical properties of the liquid. Another factor that influences the type of container used for storage and transport of liquids is the sample volume requirements for the specific analyses to be performed. For example, oil samples may be contained in wide-mouth glass jars, similar to containers used for unconsolidated samples. Since samples collected for VOC analysis may undergo a loss of volatile constituents, vials used for water samples collected for subsequent VOC analysis must be fitted with Teflon™ septa and must be overfilled before closing to ensure that no headspace (air) is present in the vial. Other constituents may be subject to photochemical degradation and thus require collection into amber glass containers. Preservatives that must be used for liquid samples are specific to the nature and chemical properties of the specific analytes for which analysis is to be conducted. Information on sample collection requirements are provided in the QAPP and/or project-specific work plan.

2.3 Gasses

Gasses are intrinsically mobile and must be contained in fully-enclosed containers. The following types of container are available: Tedlar™ bags and glass bulbs with Teflon™ septa to allow insertion of hypodermic syringes. Summa® canisters are also typically used, especially for sub-slab soil vapor samples and indoor air samples that are used to evaluate vapor intrusion. Specifications for sample collection devices for gas samples should be selected based on data quality objectives for the project and will be specified in the project-specific QAPP and work plan.

3.0 PRESERVATION

Preservation requirements are provided in the QAPP and/or site-specific work plan that is developed for a project. Should there be any questions regarding preservation of samples, the analytical laboratory should be contacted or the most current update of EPA SW-846 should be consulted.

3.1 Refrigeration

Samples which do not require refrigeration are: oil samples; gaseous samples; and water samples to be analyzed only for metals. All other samples must be kept cool (ideally at 4°C ± 2°C) until delivery to the lab for analysis. Soil samples intended for VOC analysis should be preserved and otherwise managed in accordance with HRP SOP # 105.

Samples must not be allowed to freeze in cold weather. The jars/vials could break and the samples will be lost. Storage and transport containers and modes of transport must take the potential for freezing into account.

3.2 pH Adjustment and Other Preservatives

The pH of water samples should be adjusted in the field, as necessary, using the preservatives which are specified in the QAPP and/or site-specific work plan or the most recent SW-846 promulgated method for the requisite analytical parameter. Questions on preservatives should be directed to the analytical testing laboratory.

Gaseous samples do not require preservatives or pH-adjusting compounds to be added. In general, samples of unconsolidated material (soil, concrete, sediment) or sludge do not require the addition of a preservative. The exception is analysis for VOCs, in which case soil and sediment samples should be collected using EPA Method 5035A. These samples should be collected in vials pre-preserved with methanol and/or sodium bisulfate. The soil/preservative ratio should be indicated on the sampling container prior to sample collection or obtained directly from the testing laboratory. Additional detail on sample collection for subsequent VOC analysis is provided in HRP's SOP #105, as noted in Section 2.1.

3.3 Holding Times

Holding times for various parameters are specifically indicated in the most recent EPA SW-846 promulgated method for the requisite analytical parameter. Questions on holding times should be directed to the analytical laboratory. Additional information regarding sampling containers, preservation, and holding times will be made available in the QAPP and/or site-specific work plan.

4.0 SAMPLE COLLECTION AND PREPARATION

Samples will collected into appropriate, laboratory-supplied containers recommended for the media and analytical methods, as indicated in Section 2.0, and other relevant documents, such as the QAPP and site-specific work plan.

4.1 Filtration

Groundwater samples should not be filtered prior to analysis, except as allowed in accordance with regulatory guidance. The appropriateness of filtration for water samples and filter size is based on a number of factors, including objectives for the sampling effort, data quality objectives for the project, and regulatory considerations related to filtration of water samples. The need for filtration of groundwater samples must be discussed in the project-specific work plan, and the discussion must include the rationale for collection of filtered groundwater samples, as well as the procedures that would be used for collection of the filtered samples. Unless specifically indicated otherwise in a project-specific work plan (and the rationale for such a decision must be provided), an unfiltered sample should always be collected for analysis in addition to the filtered sample.

Whenever possible, an in-line filter should be used to filter groundwater samples as the water is withdrawn from the well. The selection of which, if any, filter should be used depends on the data quality objectives for the project and will be specified in the QAPP and/or site-specific work plan. A 0.45-micron filter is used for samples for which the objective is to obtain results for dissolved constituents (usually metals). A 10-micron filter is used to distinguish analytical results for dissolved plus colloidal constituents vs. analytical results that include constituents that might be absorbed onto fine-grained particles that are present in the water sample.

In some cases, water samples other than groundwater samples must be filtered in the field prior to sample collection into appropriate sampling bottles. To accomplish this, a sample of the water to be filtered is collected into a clean container with sufficient volume to fill all sampling containers for which a filtered sample is necessary. If electric power is unavailable, battery packs are required to operate the peristaltic pump. A ring stand with clamp to hold the in-line filter is optional but may be useful.

The procedure for filtration of water samples from a source other than a monitoring well is as follows:

- A sufficient length of new Tygon™ tubing (or tubing of other appropriate inert material) is inserted into a peristaltic pump.
- The input end of the tubing is then inserted into the unfiltered water sample, and an in-line filter (0.45-micron or 10-micron filter, as appropriate, depending on the objective for the sampling event) is inserted into the output end of the tubing.
- An additional length of tubing is connected to the other end of the in-line filter to better direct the filtered water into the sample bottle(s). The flow direction shown on the filter must match the actual flow direction.
- Once the in-line filter is placed over the sample container, the pump is then turned on and run until sample collection is complete.

As noted above for filtration of groundwater samples from monitoring wells, the selection of which, if any, filter should be used depends on the data quality objectives for the project and will be specified in the QAPP and/or site-specific work plan.

4.2 Compositing

Compositing of samples for investigation purposes is strongly discouraged. Therefore, compositing of soil or water should only be performed if specifically indicated in the project-specific work plan, and the specific rationale and approach to compositing should be clearly described in that document.

However, compositing of similar materials for the purposes of obtaining waste disposition approvals is generally acceptable, and often required. Careful consideration should be given to the objectives of the sampling before collection of any composite sample is performed.

Those soil samples to be analyzed for non-volatile parameters may be mixed in any convenient, clean container. Soil samples to be analyzed for volatile organic compounds should not be composited.

For waste oil and other wastes, only those of similar appearance (color, viscosity, suspended material, odor if determined) should be composited. Liquid samples may be composited by pouring the appropriate percentages into the sample container to be sent to the laboratory.

4.3 Chain-of-Custody Procedures

4.3.1 Chain-of-Custody Form

A copy of a representative chain-of-custody form is provided in Attachment A. The sampler must fill in all relevant information as indicated on the form, including the "laboratory preparation" section. Any preparation required should be indicated on the form. The sampler must sign the form in the space indicated, including data and time of transfer, when relinquishing samples to another individual or to the laboratory. Each successive handler of the samples must also sign the form with data and time when relinquishing samples, and the receiving entity must acknowledge receipt.

4.3.2 Sample Labeling Nomenclature

Samples shall be labeled with the following information:

- Date
- HRP
- HRP Job #
- Sample identification. Samples from test borings must have, in addition to the test boring identification, the depth from which the sample was retrieved.
- Special labeling requirements may also be required for certain jobs. These requirements should be detailed in the QAPP and/or project-specific work plan.

4.3.3 Delivery/Receipt Procedures

As noted above, the chain-of-custody forms must be signed by both the person delivering the samples and the person receiving them. The time and date of transfer must be indicated.

5.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

5.1 Blanks

Field, trip, and equipment blanks are slightly different from one another. For preparation of an equipment blank, an appropriate blank material (deionized water) is brought in contact with the pre-cleaned sampling tools used for "real" samples. Equipment blanks, in theory, indicate whether the sampling equipment has been properly decontaminated. Field blanks are prepared by carrying the blank material to the sampling site and placing it in appropriate containers. Field blanks are used to determine whether airborne contamination is present at the sampling site. Field blanks are collected only when airborne contamination is suspected. Trip blanks are prepared at the analytical laboratory and transported to the site in sealed containers. They are used to evaluate the potential for contamination that may be attributed to shipping and handling procedures. Temperature blanks are prepared prior to sampling. They document the temperature preservation of samples upon receipt at the laboratory.

Blank samples are typically used for quality control and quality assurance. They provide qualitative information concerning contamination, handling and shipping procedures which may affect the quality of data that is collected. The rate at which blank samples are collected depends on the DQOs established for the project, but are typically prepared at a rate of 5% (i.e., 1 per 20 samples). For VOC analyses, trip blanks are prepared at a rate of 1 per shipping container in which samples for VOC analysis are transported. In some cases, blank samples may be collected at a rate of 1 per day if less than 20 samples have been collected. A group of samples that are transported together generally constitutes the sample delivery group (SDG). Specific requirements for collection of blank samples should be provided in the project-specific QAPP and work plan.

Water: Water for blanks shall consist of analyte-free water. The blank sample should be collected in the same kind of container used for the other water samples. Blank samples should be given plausible "well" identifications such as "MW-28". Trip blanks are typically analyzed only for VOCs. Analysis of equipment and field blanks are generally determined on a site-by-site basis or as specified in a site-specific work plan or QAPP.

Soil: Due to difficulties in preparing representative samples, blanks comprised of soil are uncommon.

5.2 Duplicates

True duplicates of samples cannot really be obtained, but replicate samples (which are commonly referred to as “duplicates”) should be collected as near as possible, both in time as well as space, to their principal samples. Depending on project objectives, sampling identification may indicate to the laboratory that the sample is a duplicate of another sample or the sample may be submitted to the laboratory as a “blind duplicate,” i.e., with no indication in the sample identifier that the sample is a duplicate or replicate of another sample.

Information regarding the collection of duplicate samples will be specified in the QAPP and/or project-specific work plan.

6.0 REFERENCES

New York State Department of Environmental Conservation (NYSDEC). 2010. *DER-10, Technical Guidance for Site Investigation and Remediation*, Division of Environmental Remediation. May 2010.

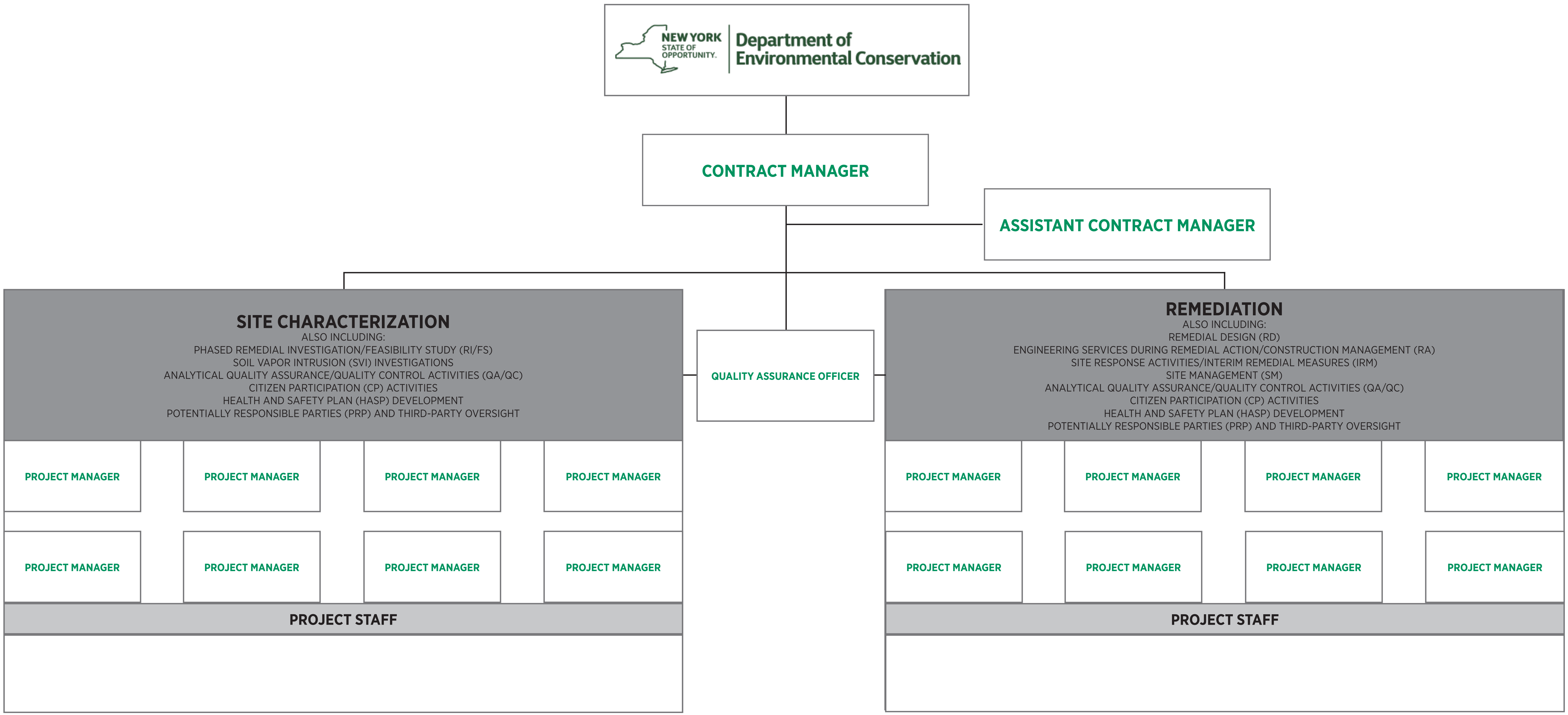
NYSDEC, Technical Procedure Guidance, Quality Assurance/Quality Control Procedures, *Spill Guidance Manual*, Section 2.4.

USEPA. 2015. *Standard Operating Procedure - Sample Receiving, Handling, and Storage,* SERAS SOP No. 1008, Rev. 2.1, Scientific, Engineering, Response and Analytical Services, December 9, 2015.

FIGURE

FIGURE 1

REPRESENTATIVE ORGANIZATION CHART



ATTACHMENT A

Representative Chain-of-Custody Form

con-test ANALYTICAL LABORATORY
Phone: 413-525-2332
Fax: 413-525-6405
Email: info@contestlabs.com
http://www.contestlabs.com
39 Spruce Street
East Longmeadow, MA 01028

CHAIN OF CUSTODY RECORD

Company Name:
Address:
Phone:
Project Name:
Project Location:
Project Number:
Project Manager:
Con-Test Quote Name/Number:
Invoice Recipient:
Sampled By:

Requested Turnaround Time
7-Day ☐ 10-Day ☐
Due Date:

Rush-Approval Required
1-Day ☐ 3-Day ☐
2-Day ☐ 4-Day ☐

Data Delivery
Format: PDF ☐ EXCEL ☐
Other:
CLP Like Data Pkg Required: ☐
Email To:
Fax To #:

# of Containers
[2] Preservation Code
[3] Container Code

ANALYSIS REQUESTED

Dissolved Metals Samples
O Field Filtered
O Lab to Filter

Orthophosphate Samples
O Field Filtered
O Lab to Filter

Con-Test Work Order#	Client Sample ID / Description	Beginning Date/Time	Ending Date/Time	Composite	Grab	[1]Matrix Code	Conc Code

Comments:

Please use the following codes to indicate possible sample concentration within the **Conc Code** column above:
H - High; M - Medium; L - Low; C - Clean; U - Unknown

[1] **Matrix Codes:**
GW = Ground Water
WW = Waste Water
DW = Drinking Water
A = Air
S = Soil
SL = Sludge
SOL = Solid
O = Other (please define)

[2] **Preservation Codes:**
I = Iced
H = HCL
M = Methanol
N = Nitric Acid
S = Sulfuric Acid
B = Sodium Bisulfate
X = Sodium Hydroxide
T = Sodium Thiosulfate
O = Other (please define)

[3] **Container Codes:**
A = Amber Glass
G = Glass
P = Plastic
ST = Sterile
V = Vial
S = Summa Canister
T = Tedlar Bag
O = Other (please define)

Relinquished by: (signature)	Date/Time:
Received by: (signature)	Date/Time:
Relinquished by: (signature)	Date/Time:
Received by: (signature)	Date/Time:
Relinquished by: (signature)	Date/Time:
Received by: (signature)	Date/Time:

Detection Limit Requirements
MA
CT
Other:

Special Requirements
☐ MA MCP Required
MCP Certification Form Required
☐ CT RCP Required
RCP Certification Form Required
☐ MA State DW Required
PWSID #

con-test® ANALYTICAL LABORATORY
www.contestlabs.com
NELAC and AIHA-LAP, LLC Accredited

Project Entity
☐ Government ☐ Municipality ☐ MWRA ☐ WRTA
☐ Federal ☐ 21 J ☐ School
☐ City ☐ Brownfield ☐ MBTA

Other
☐ Chromatogram
☐ *AIHA-LAP,LLC*

PCB ONLY
☐ Soxhlet
☐ Non Soxhlet

Recommended Containers, Preservation, Storage, & Holding Times For Water, Drinking Water, and Wastewater

Description	Method	Matrix	Sample container	Preservative	Prep/Analysis Holding Time	Volume
Organic Analyses						
EDB, DBCP	504.1	H_2O	40ml Vial Teflon septa	Cool 4°C $Na_2S_2O_3$	14 days	40 ml
GCMS - Volatiles	524.2	H_2O	40ml Vial Teflon septa	Cool 4°C Ascorbic acid & HCL to pH<2	14 days	40 ml
	624, 8260	H_2O	40ml Vial Teflon septa	Cool 4°C HCL to pH<2	14 days	40 ml
GC-Pesticides & PCBs	608	H_2O	Amber Glass Teflon Cap	Cool 4°C NaOH or H_2SO_4 to pH 5-9	7/40 days	1 Liter
GC-Pesticides & PCBs	8081, 8082	H_2O	Amber Glass Teflon Cap	Cool 4°C	7/40 days	1 Liter
GC/MS-Semivolatiles - PAH's Base Neutral/Acid Extractables	625, 8270	H_2O	Amber Glass Teflon Cap	Cool 4°C	7/40 days	1 Liter
Petroleum Hydrocarbons						
Oil & Grease	1664	H_2O	Amber Glass Teflon Cap	Cool 4°C H_2SO_4 to pH<2	28 days	1 Liter
Diesel Range Organics (DRO)	Modified 8015B	H_2O	Glass Teflon Cap	Cool 4°C	7/40 days	1 Liter
Gasoline Range Organics (GRO)	Modified 8015B	H_2O	Glass Teflon Cap	Cool 4°C HCL to pH<2	14 days	40 ml
Total Petroleum Hydrocarbons (TPH) by GC	Modified 8100	H_2O	Glass Teflon Cap	Cool 4°C	7/40 days	1 Liter
MA DEP VPH	98-1	H_2O	40ml Vial Teflon septa	Cool 4°C 3-4 drops of 1:1HCL	14 days	40 ml
MA DEP EPH	97-12	H_2O	Amber Glass Teflon Cap	Cool 4°C 5 ml of 1:1HCL	14/40 days	1 Liter
CT ETPH	CT ETPH	H_2O	Amber Glass Teflon Cap	Cool 4°C	14/40 days	1 Liter
Metals						
ICP/ICPMS Metals	200.7/200.8 6010/6020	H_2O	Plastic / Glass	Cool 4°C HNO_3 to pH<2	6 months	DW-1L WW-250ml
Mercury (Hg)	245.1/7470A	H_2O	Plastic / Glass	Cool 4°C HNO_3 to pH<2	28 days	DW-1L WW-250ml
Chromium VI (Cr^{+6})	SM 3500 Cr D	H_2O	Plastic / Glass	Cool 4°C	24 hours	200 ml
Chromium VI (Cr^{+6})	SW-846 7196A	H_2O	Plastic / Glass *	Cool 4°C	24 hours	200 ml
Inorganic/Wet Chemistry						
Alkalinity	SM 2320B	H_2O	Plastic / Glass *	No Headspace Cool 4°C	14 days	250 ml
BOD	SM 5210B	H_2O	Plastic / Glass	Cool 4°C	48 hours	1 Liter
Chloride	SM 4500 Cl B	H_2O	Plastic / Glass	Not Required	28 days	250 ml
Chlorine, Total Residual	SM4500 Cl G	H_2O	Plastic / Glass	Not Required	Analyze immediately	250 ml
COD	410.4/Hach 8000	H_2O	Plastic / Glass	Cool 4°C H_2SO_4 to pH<2	28 days	250 ml
Coliform, Fecal	SM 9222D	H_2O	Sterile Plastic	Cool 4°C	6 hours	100 ml
Coliform, Total	SM 9222B	H_2O	Sterile Plastic	Cool 4°C	30 hours	100 ml
E. Coli confirmation	SM 9222G	H_2O	Sterile Plastic	Cool 4°C	30 hours	100 ml
Heterotropic Plate Count	SM 9215B	H_2O	Sterile Plastic	Cool 4°C	8 hours	100 ml

Description	Method	Matrix	Sample container	Preservative	Prep/Analysis Holding Time	Volume
Inorganic/Wet Chemistry (continued)						
Color	SM 2120B	H_2O	Sterile Plastic	Cool 4°C	48 hours	200 ml
Conductance	SM 2510B	H_2O	Plastic / Glass	Cool 4°C	28 days	100 ml
Cyanide, Amenable	SM4500 Cn-C,E	H_2O	Amber Glass	Cool 4°C NaOH to pH>12	14 days	500 ml
Cyanide, Free	SM4500 Cn-C,E	H_2O	Plastic / Glass	Cool 4°C NaOH to pH>12	14 days	500 ml
Cyanide, Total	SM4500 Cn-C,E	H_2O	Plastic / Glass	Cool 4°C NaOH to pH>12	14 days	500 ml
Flashpoint	SW 846 1010	H_2O	Plastic / Glass	Cool 4°C	ASAP	50 ml
Flouride (drinking water)	SM 4500F-C	H_2O	Plastic / Glass	Not Required	28 days	200 ml
Hardness	SM 2340C	H_2O	Plastic / Glass	Cool 4°C	6 months	250 ml
MBAS (Surfactants)	SM5540C	H_2O	Plastic / Glass	Cool 4°C	48 hours	250 ml
Nitrogen, Ammonia	SM 4500 NH3C	H_2O	Plastic / Glass	Cool 4°C H_2SO_4 to pH<2	28 days	250 ml
Nitrogen, Total Kjeldahl	SM 4500-N Org B, C,	H_2O	Plastic / Glass	Cool 4°C H_2SO_4 to pH<2	28 days	500 ml
Nitrogen, Nitrate	SM 4500 NO3 F	H_2O	Plastic / Glass	Cool 4°C H_2SO_4 to pH<2	48 hours / 28 days preserved	250 ml
Nitrogen, Nitrite	SM 4500 NO2 B	H_2O	Plastic / Glass	Cool 4° C	48 hours	100 ml
Nitrogen, Nitrate + Nitrite	SM 4500 NO3 F	H_2O	Plastic / Glass	Cool 4° C H_2SO_4 to pH<2	48 hours / 28 days preserved	100 ml
Odor	SM 2150B	H_2O	Plastic / Glass	Cool 4°C	24 hours	500 ml
Orthophosphate	SM 4500 P E	H_2O	Plastic / Glass	Cool 4°C	48 hours	100 ml
Oxygen, Dissolved	SM 4500 O-C1 SM S210B	H_2O	Plastic / Glass with glass top	Cool 4°C	Analyze immediately	300 ml
pH, Hydrogen ion	SM 4500 H-B	H_2O	Plastic / Glass	Not Required	Analyze immediately	25 ml
Phenolics	420.1	H_2O	Plastic / Glass	Cool 4°C H_2SO_4 to pH<2	28 days	1 Liter
Phosphorous, Total	SM4500P-E	H_2O	Plastic / Glass	Cool 4°C H_2SO_4 to pH<2	28 days	500 ml
Total Dissolved Solids (TDS)	SM 2540C	H_2O	Plastic / Glass	Cool 4°C	7 days	300 ml
Total Suspended Solids (TSS)	SM 2540D	H_2O	Plastic / Glass	Cool 4°C	7 days	300 ml
Settleable Solids	SM 2540 F	H_2O	Plastic / Glass	Cool 4°C	48 hours	1 Liter
Sulfate	ASTM DS16-90	H_2O	Plastic / Glass	Cool 4°C	28 days	300 ml
Sulfide	SM 4500 S2,E	H_2O	Plastic / Glass with Glass top	Cool 4°C NaOH to pH>9 2N Zn Acetate	Analyze immediately	500 ml
Sulfite	377.1 / SM 4500 SO3	H_2O	Plastic / Glass	Not Required	Analyze immediately	100 ml
Total Organic Carbon (TOC)	SM S310B	H_2O	Amber Glass Teflon Cap	Cool 4°C HCL to pH<2	28 days	100 ml
Turbidity	180.1 / SM 2130 B	H_2O	Plastic / Glass	Cool 4°C	48 hours	100 ml

Recommended Containers, Preservation, Storage, & Holding Times For Soil, Solids, and Other Wastes

Description	Method	Matrix	Sample container	Preservative	Prep/Analysis Holding Time	Volume
Organic Analyses						
GCMS - Volatiles	8260B	Soil/Waste	Glass w/ Teflon Septa	Cool 4°C 15 ml CH_3OH or 5 ml NaHSO4 5 or ml DI H_2O	14 days	15g or 5g or 5g
GC-Pestacides & PCBs	8081A/8082	Soil/Waste	Glass w/ Teflon Septa	Cool 4°C	14/40 days	100 g or 8oz Jar
GC/MS-Semivolatiles - PAH's Base Neutral/Acid Extractables	8270C	Soil/Waste	Glass w/ Teflon Septa	Cool 4°C	14/40 days	100 g or 8oz Jar
Petroleum Hydrocarbons						
Diesel Range Organics (DRO)	Modified 8015B	Soil	Glass w/ Teflon Septa	Cool 4°C	14/40 days	100 g or 8oz Jar
Gasoline Range Organics (GRO)	Modified 8015B	Soil	Glass w/ Teflon Septa	Cool 4°C 15 ml CH_3OH	14 days	15 grams
Total Petroleum Hydrocarbons (TPH) by GC	Modified 8100	Soil	Glass w/ Teflon Septa	Cool 4°C	14/40 days	100 g or 8oz Jar
MA DEP VPH	98-1	Soil	40ml Vial Teflon septa	Cool 4°C 15 ml CH_3OH	14 days	15 grams
MA DEP EPH	97-12	Soil	Amber Glass Teflon Cap	Cool 4°C	14/40 days	100 g or 8oz Jar
CT ETPH	CT ETPH	Soil	Glass w/ Teflon Septa	Cool 4°C	14/40 days	100 g or 8oz Jar

Description	Method	Matrix	Sample container	Preservative	Prep/Analysis Holding Time	Volume
Metals						
ICP Metals	6010	Soil	Plastic / Glass	Cool 4°C	6 months	100 g or 8oz Jar
Chromium VI (Cr^{+6})	SW-846 7196A	Soil	Plastic / Glass *	Cool 4°C	24 hours	(2) - 2oz Jars
Mercury (Hg)	7471	Soil	Plastic / Glass	Cool 4°C	28 days	100 g or 8oz Jar
Inorganic/Wet Chemistry						
General Inorganics	9000 Series	Soil	Glass Teflon Cap	Cool 4°C	See Table 1.	100 g or 8oz Jar
Flashpoint/Ignitibility	1010	Soil	Glass Teflon Cap	Cool 4°C	ASAP	100 g or 8oz Jar
pH/Corrosivity	9045C	Soil/Waste	Plastic / Glass	Cool 4°C	ASAP	100 g or 2oz Jar
Reactivity	SW 846 (7.3)	Soil/Waste	Plastic / Glass	Cool 4°C	ASAP	100 g or 8oz Jar
TCLP/SPLP	1311/1312	Soil/Waste	Glass Teflon Cap	Cool 4°C	Varied	500g or 32 oz Jar
TCLP/SPLP	1311/1312	Soil/Waste	Glass Teflon Cap	Cool 4°C	Varied	500g or 32 oz Jar

* Requires it's own container

con-test® ANALYTICAL LABORATORY

Revised 04.05.10

HRP Associates, Inc.

STANDARD OPERATING PROCEDURE
for

Field Screening

SOP #108

Revision Date: August 8, 2019

LIST OF REVISIONS

Date	Summary of Changes	Approval
	Original document preparation	
8/2019	Multiple revisions throughout document	Gail L. Batchelder, Ph.D.

Reviewed by:

Technical Director/
HRP Quality Assurance Officer

Gail L. Batchelder, Ph.D., P.G., L.E.P.

August 8, 2019
Date

Vice President/
Practice Leader - Environmental

Scot Kuhn, P.G., L.E.P.

August 8, 2019
Date

TABLE OF CONTENTS

1.0 INTRODUCTION

This SOP identifies the general procedures to be used for screening of soil and water samples during the performance of field activities. Field-screening procedures include use of tool, instrument, or technique that results in the collection of real-time or near real-time environmental data.

Equipment: Equipment used for field screening varies by the type of screening to be performed. The types of equipment needed for each field screening technique are identified in the specific sections of this SOP associated with the individual types of field screening procedures.

Documentation: Field notebook, map, and/or field work sheets, including geologic boring logs, to detail location of sampling points and relevant information related to sample collection and field screening measurements.

This SOP has been prepared to describe standard procedures that will be used in most cases during the performance of field screening activities. However, nothing in this standard operating procedure is intended to preclude the application of sound professional judgement during the performance of field activities. Should situations arise that require alternative procedures to those described herein in order to accomplish overall project objectives or to meet data quality objectives, field personnel should document the rationale for changes to the standard procedures in the field paperwork and describes the procedures that were followed instead. In some cases, the need for changes to standard protocols may be recognized ahead of time, in which case, the procedures to be followed should be described in project-specific work plans or work instructions.

Similarly, the procedures described herein are not intended to conflict with any specific federal, state, or local statutes, regulations, guidance, protocols, or specific instructions of a regulatory authority. If changes to the SOP are needed, such changes should be identified in project-specific work plans or other similar document that will be maintained in the project record.

2.0 FIELD SCREENING PHYSICAL METHODS

2.1 Visual Observations

Visual observations of samples being collected during environmental investigations can be an important tool in understanding the hydrogeology and/or geochemistry at and in the vicinity of the location where the sample was collected and provide useful information for development of the conceptual site model and selection of individual samples for subsequent laboratory analysis. Therefore, detailed descriptions of soil and water characteristics are considered to be an important component of field screening procedures.

For soil, observations should include such characteristics as color, texture and grain-size distribution, relative moisture content, and relative density. Characterization of soil samples should be recorded in the field on geologic boring logs for soil samples collected from soil borings. Descriptions of soil samples for other collection methods should be recorded on appropriate field paperwork designated for that purpose.

Visual observations should be in accordance with one or more standard protocols for visual identification of soil samples based on grain-size distribution and physical characteristics of the soil sample. Specifically, soil descriptions and classifications should be performed in accordance with ASTM Standard D2488-17, *Practice for Description and Identification of Soils (Visual-Manual Procedure)* and ASTM Standard D2487-17*, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System),* and/or HRP's SOP #103 *Soil Logging Using a Modified Burmister Classification System,* as appropriate based on the data quality objectives for the project and any regulatory requirements or guidance.

For water, the sampler should record such observations as color; turbidity; and amount, nature, and color of any suspended material as settling occurs. If a sheen or separate-phase non-aqueous-phase liquid (NAPL) is observed, that should be noted, and the nature of the observation with respect to color, general appearance, and density relative to the water sample (i.e., whether the separate-phase accumulates at the top of a container of the water or at the bottom), which would indicate whether the separate-phase liquid is light NAPL (LNAPL) or dense NAPL (DNAPL).

2.2 Olfactory Observation

Olfactory observations should be noted only if odors are evident in ambient air conditions. Under <u>no</u> circumstances are personnel allowed to directly smell samples from containers. Only if the nature of the odor is clearly recognizable as attributable to a certain type of chemical (such as petroleum product or chlorinated solvent, for example), is it permissible to record that aspect of the olfactory observation on the field boring log or in field notes.

3.0 NON-AQUEOUS-PHASE LIQUID (NAPL) DETERMINATION KITS (SOILS)

Where NAPL is suspected based upon historical site knowledge or elevated screening levels for volatile organic compounds, project-specific DQOs for data collection may include an evaluation of the presence NAPL in the field. Commercial NAPL detection/screening products will be used by HRP personnel. In all cases, manufacturer's instructions will be followed. Non-Sudan IV based dyes will be preferentially selected as a non-toxic, hydrophobic indicator of the presence NAPL. Sudan IV based dyes should not be selected unless specifically required by a state of federal agency, due to the recent determination that Sudan IV dye is a mutagen. The limitations of the specific products selected should be well understood prior to use, and it should be recognized that any product is more likely to yield a false-negative result than a false-positive result, so information gained during field screening for the presence of NAPL must be reviewed in conjunction with other data available for each sample and for the investigation area as a whole.

Personal protective equipment (PPE) should be donned and maintained in accordance with the site-specific work plan and/or health and safety plan during the sampling and screening procedures. In the event that no PPE has been specified for a particular sampling event, disposable latex gloves should be donned, at a minimum, during all sampling procedures. Gloves must be changed after each individual sample collection event.

Sampling/screening equipment will be largely determined by manufacturer's instructions. Commercial test kits may consist of pre-measured dye packets that are enclosed in clean sampling cups. Specified quantities of soils are emplaced in the sampling cups, taking care not to disturb the dye package. Clean tap water is then added to the container. The container is sealed and shaken vigorously. If NAPL is present at a concentration generally greater than 500 ppm, it will separate from the soils and change color. The color of the NAPL will be dependent on the test kit selected. The sampling kits and soils should be containerized and properly disposed.

4.0 FIELD INSTRUMENT SCREENING

4.1 Photoionization Detector (PID)

PIDs are used during the performance of field activities for general screening of soil, water, or air for the presence of volatile organic compounds (VOCs). The instrument is used only to screen for the presence of total concentrations of VOCs, not for the presence of individual constituents, and not all constituents of interest may be detected by the instrument.

PIDs can only monitor air quality, and no water/soil should be introduced into sample line. This method has limited use in high humidity or in the presence of methane or other compounds that have high ionization potentials. However, performance may be improved by using a vapor trap in PID models that may be equipped with one.

Users should refer to the operation manual for the instrument being used to ensure that electron voltage for the bulb used is appropriate for compounds to be detected. Halogenated alkanes, such as 1,1,1-trichloroethane, or higher molecular weight aromatic compounds traditionally use a higher electron volt bulbs (11.7 ev) due to the increased strength of bonding force of these chemicals. For general screening of matrices, use a 10.6 electron volt bulb as an "all purpose" bulb; but a predetermination of compounds to be detected is helpful before making this decision. Generally, straight-chain hydrocarbon carbons are not ionizable using a PID, and therefore, the presence of those compounds will not be detected by the instrument.

4.1.1 Specific Equipment List

- Photoionization detector
- Sealable plastic/polyethylene bags
- Personal protection equipment
- Calibration gas

4.1.2 Documentation

- Site plan
- Activity log/sample log
- Notebook – sketch pad

4.1.3 Procedure

Following calibration of instrument:

1. Record background reading.
2. Place a small quantity of matrix to be tested into a sealable plastic/polyethylene bag.
3. Let matrix warm to room temperature.
4. Insert probe tip into bag (<u>do not</u> insert probe into matrix).
5. Record reading.

Samples that are wet may give a false positive reading. This effect is present when readings gradually increase with no discernable leveling off. If this effect is observed, the instrument bulb should be cleaned, and the instrument recalibrated, prior to re-testing the sample. If the response persists, the screening results should be noted as suspect. However, to help minimize the effect of moisture on screening results, some PID models may be equipped with a moisture trap to remove at least some of the moisture as the air enters the instrument.

For air monitoring purposes one can either wear the monitor with straps or have monitor in the exclusion zone close and at the breathing zone level. Instrument readings will be recorded through time at intervals specified in the health and safety plan.

For water samples, place approximately 10 milliliters (ml) of water in a non-preserved glass 40 ml VOA vial. Shake vigorously and allow to settle. Open vial and tip cap slightly sideways to allow entrance of instrument probe. Do not insert probe into water, as the instrument pump will draw water into the sample line and to the bulb, which will ruin the instrument and bulb.

4.2 Gas Chromatograph

4.2.1 Specific Equipment List

- Portable gas chromatograph with a pre-column, backflush oven, and PID detector
- Ultra-zero air
- Water standards/blanks
- Syringes

4.2.2 Documentation

- Site plan
- Activity log
- Organic vapor headspace form
- Notebook – sketch pad

4.2.3 Procedure

A portable gas chromatograph with a pre-column, backflush oven, and PID/FID detector is used to analyze the "headspace gas" obtained from each soil sample. The peak amplitudes and retention times obtained from each sample are compared to standard peaks and retention times obtained from prepared in-house standards from a suite of volatile organic compounds expected, or likely, to be present in the media sampled. Based on a comparison of the sample results with the standards, the amounts and types of contaminants in each sample are determined.

The headspace screening is performed on-site in a mobile trailer laboratory, a support vehicle, or in a designated location in a site building. This is an initial semi-quantitative "headspace" screening only and is not a state-certified laboratory analysis performed using standard EPA methods.

"Ultra-zero air" certified to contain less than 0.1 parts per million (ppm) total hydrocarbons is used as the carrier gas. The gas chromatograph's oven runs isothermally at 40ºC. The total run time for each sample is sufficient to allow analysis of the targeted volatile organics. Both sample and standard injection volumes are recorded to allow direct quantification between standards and unknowns. The carrier gas flow rate is also held constant at approximately 10 cubic centimeters (cc)/minute to assure constant retention times.

During the screening, a Quality Assurance/Quality Control (QA/QC) program is followed. The purpose of the QA/QC program is to assure that any soil contamination detected in the soil samples did not arise from interferences and to provide semi-quantitative basis for sample evaluation.

The QA/QC program consists of a periodic injection of "headspace" gas obtained from water standards and analysis of "blanks". Calibration standards of specific compounds and a range of concentrations for certain targeted volatile organic compounds will be obtained from a state-certified laboratory or prepared by HRP (determined on a site-specific basis). These standards are injected into the GC, and results for the targeted compounds are then stored in the GC's "memory" prior to sample collection. Various "blank" analyses were performed to evaluate potential avenues of cross-contamination.

"Blank" analyses consist of:

1. Instrument blanks (no injection) to check the potential for column carry-over and "ultra-zero air" cleanliness;
2. Syringe blanks to check the potential for needle carry-over;
3. Soil sample container blanks to determine container cleanliness (although sample containers are pre-tested for contaminants under a QA/QC program which is completed by the manufacturer of the containers); and
4. Ambient "background" air blanks in both the sample collection and instrument areas to check the potential for cross-contamination from airborne contaminant sources.

All chromatograms are stored on a computer library and are later downloaded to a hard copy. Peak areas are integrated by the GC's computer by comparison with standards pre-programmed into the library. Preparations containing selected potential site contaminants are generally injected into the GC to "check" retention times on a twice daily basis.

The objectives of the QA/QC program are achieved on the sampling dates when:

1. GC column carry-over is not found to be significantly interfering with any of the analyses;
2. Carry-over syringe contamination is not detected after any sample injection;
3. No interference due to volatile organic contamination is detected in any container blanks (e.g. 40 ml VOA septa soil sampling jar);
4. Ambient air in the sample analysis area and outside the building is not found to be significantly interfering with the soil sample screening results; and
5. The "ultra-zero air" used in the gas chromatograph has no contaminants present before testing.

4.3 Specific Conductance, pH, Dissolved Oxygen, Oxidation/reduction Potential

Screening-level measurements of the standard water-quality parameters of specific conductance, pH, dissolved oxygen (DO), and oxidation/reduction potential (ORP), may be made using stand-alone instruments specific to the parameter being measured, or by combination instruments that measure one or more of the parameters at the same time. The most common type of combination measurement technique currently used is a flow-through cell that is used in conjunction with low-flow groundwater sampling techniques. When using a flow-through cell, measurements are made using specific electrodes within a closed cell as groundwater is pumped from a well at a low flow rate moves through the cell. In contrast, most stand-alone meters require that separate aliquots of water be collected into a container that is exposed to the atmosphere as the electrodes equilibrate in the solution and measurements are recorded.

Although the equipment varies depending on the instrument(s) used, documentation is the same for all types or combinations of instruments. Documentation needs include the following:

- Activity Report
- Notebook
- Monitor Well Data Sheet or field sampling log (for water samples other than groundwater).

In all cases, instruments should be used, calibrated, and maintained in accordance with manufacturer's instructions. Information provided in the following sub-sections is provided as an overview of information related to measurement of specific parameters. Additional, more detailed information can found in the operating manuals for the specific equipment and in the references provided in Section 7.0 of this SOP.

4.3.1 Specific Conductance

Conductivity/salinity meters are used to determine the electrical conductance and salinity of water/wastewater. Values are generally expressed in µmhos/cm or µS/cm (µSiemens/cm).

4.3.1.1. Specific Equipment List

- Instrumentation for measurement of specific conductance (e.g., conductivity/salinity meter, hand-held conductivity meter)
- Calibration solution

4.3.1.2. Procedure

Calibration of the instrument must be performed prior to measurement of specific conductance for individual samples. All calibration procedures and measurements of specific conductance for samples will be conducted in accordance with manufacturer's instructions for the specific instrument being used. Specific conductance readings are affected by temperature, so it is important that the instrument settings are adjusted to take the temperature into account or to ensure that the specific conductance meter uses an automatic temperature compensator.

4.3.2 pH

The pH meter is used for determining the acidity of water and wastewater as expressed in pH units.

4.3.2.1. Specific Equipment List

- Instrumentation used to measure pH (may be a combination meter that measures other parameters or may be a stand-alone, hand-held pH meter).
- Standard pH calibration solutions (pH 4.0, pH 7.0, pH 10.)

4.3.2.2. Procedure

Following calibration procedures, immerse end of probe into liquid sample (an aliquot of sample not used for laboratory analysis). Allow probe to acclimate to sample. Meter will provide digital read-out of pH in standard pH units.

4.3.3 Dissolved Oxygen Meter

The dissolved oxygen (DO) meter is used for determining the dissolved oxygen content in milligrams per liter.

4.3.3.1. Specific Equipment List

- DO Meter
- Potassium chloride (KCl) solution
- Probe membranes

4.3.3.2. Procedure

Following calibration procedures, immerse end of probe into liquid sample (aliquot of sample not used for laboratory analysis). Allow probe to acclimate to sample. Meter will provide a digital read-out in mg/l or %. The probe should be slowly raised and lowered while remaining completely submersed in the sample in order to obtain an accurate reading.

4.3.4 Oxidation/reduction Potential

An oxidation/reduction potential measurement indicates the difference in electric potential between an indicator electrode and an appropriate reference electrode. Oxidation/reduction potential is a useful indicator of the equilibrium oxidation state of a chemical species in the water sample being tested, particularly when evaluated in conjunction with the pH of the solution. ORP is reported in millivolts (mV).

4.3.4.1. Specific Equipment List

- Instrumentation for measurement of ORP (meter, indicator electrode, reference electrode)
- Calibration solution (Zobell solution)

4.3.4.2. Procedure

ORP is temperature dependent, so the meter should have automatic temperature compensation and the probe must be allowed to equilibrate to the ambient temperature of the solution before the measurement is recorded (calibration solution must be at ambient temperature), or a separate temperature measurement must be made and the value measured by the instrument must be corrected based on the recorded temperature of the solution.

In some cases, the instruction manual will indicate that the instrument is calibrated at the factory. If so, the Zobell solution should be used to verify the factory calibration. If the two measurements do not agree, the first step is to use a new Zobell solution. If the measured value still does not agree with the value for the Zobell calibration solution, the instrument will need to be recalibrated by the manufacturer.

4.4 Turbidity

Instruments that measure turbidity measure the difference between the intensity of light scattered by a liquid sample, generally water, compared to the intensity of light scattered by a standard reference suspension. Turbidity measurements indicate the amount of suspended or colloidal material in a water sample, and results may be affected by the color of the water sample. A turbidity meter (turbidimeter) provides results in nephelometric turbidity units (NTUs).

4.4.1 Specific Equipment List

- Turbidimeter
- Calibration solution (for example, a commercially available polymer primary standards (AMCO-AEPA-1)

4.4.2 Procedure

The calibration standard (or standards if the instrument uses more than one standard) should be allowed to equilibrate to the ambient temperature. Initially, a standard with a low turbidity value (0.0 or 0.02 NTU) should be used to calibrate the instrument in accordance with the manufacturer's instructions. A 0 NTU standard solution can be prepared by filtering distilled water through a 0.45-micron filter. The instrument should read the standard value to within the specifications of the instrument. If the instrument accepts more than one standard, at least one additional standard at a relatively high turbidity value should be used. If the instrument accepts only one standard, the higher standard should be used as a check standard for the instrument to ensure that the instrument identifies the value of the check standard within the specifications of the instrument.

An important consideration when using a turbidimeter is ensuring that the cuvettes in which the water samples and calibration solution are placed for measurement are free from scratches and that the outside surface are dry and the clarity is not affected by such things as fingerprints or dust. If the cuvette cannot be cleaned, it should be discarded. Therefore, it is important to have a number of cuvettes available for each sampling event.

5.0 EQUIPMENT CALIBRATION METHODS

All field equipment will be calibrated immediately prior to use in the field. The calibration procedures will follow standard manufacturer's instructions or routine HRP procedures to assure that the equipment is functioning within tolerances established by the manufacturer and required by the project. Field personnel will document all instrument calibrations in bound field notebooks and on specific calibration forms. All records generated will be maintained by field personnel and are subject to audit by the Task or Project Manager.

The detailed calibration, operation, and maintenance procedures for field instrumentation routinely used by HRP personnel are specific to manufacturer's instructions. The following sections will briefly summarize these procedures.

Calibration standards and pH buffer solutions used for field instrumentation calibration checks will be obtained from scientific products supply companies (e.g., Fisher Scientific; American Scientific Products, etc.). All buffer and calibration standards obtained will be certified and standardized against or traceable to a reliable primary reference standard. All solutions are stored according to manufacturer's suggestion for optimal shelf-life. Chemical container labels must also include the date received, date opened, as well as the initials of the analyst who first opened the container. Stock solutions will be marked with expiration date and replaced with new solutions when the recommended shelf-life is exceeded.

5.1 Photoionization Detector (PID)

HRP uses several types of PIDs made by different manufacturers. Calibration procedures which are specific to each instrument can be found in the manufacturer's operation manual. The PIDs will be calibrated in the field, under the working temperature conditions where it is to be used. The calibration gas typically used is isobutylene at a concentration of 100 ppm. Calibrations should be recorded in the field notebook and on the calibration log of the Health and Safety Plan. Calibration records should note the date, instrument manufacturer and model, calibration gas and concentration, and operator.

5.2 Temperature/Conductance Meter

Calibration is performed at the start of each sampling day using potassium chloride (KCl) standard solutions. Calibrations are recorded in either a bound field notebook or on field calibration forms. Specific conductance standards are selected to bracket the range of values expected in the samples. If the unit has a calibration adjustment, the meter is calibrated in the same manner as the pH meter. Internal automatic adjustments are made on meters which lack a designated calibration knob. The meter must read within 10 percent of the standard to be considered in control and acceptable.

If the calibration indicates the meter is out of calibration, a backup unit should be employed. Readings from conductivity meters lacking calibration adjustments are limited to checks at the beginning and end of the sampling day. All calibrations may be recorded in a bound field notebook along with conclusions as to the acceptability of readings.

Temperature is measured using a glass thermometer. Field thermometers must be periodically checked against a National Institute of Standards Technology (NIST) thermometer. Acceptance criteria are ±1°C. Any thermometers exceeding these limits should not be used to record temperature readings. The calibration frequencies noted above are the minimum requirements. Additional checks should be performed if the unit experiences harsh conditions or if readings become erratic.

5.3 pH Meter

Calibration is performed at the start of each sampling day using at least two standard calibration solutions which bracket the pH range expected in the samples. Standard calibration solutions are available as pH 4, pH 7, and pH 10. Calibration is recorded in either a bound field notebook or on field calibration forms. Calibration knobs are used to set the meter to read the value of the standard. The meter is then checked during the sampling period, using at least one standard, at a frequency which results in little or no calibration adjustment. If the reading varies by more than one-tenth of a unit between calibration checks, the frequency of the checks must be increased. Temperature and pH must be taken on an aliquot of the sample that is not used for laboratory analysis.

5.4 Dissolved Oxygen Meter

Calibration is performed at the start of each sampling day following instructions in the operation manual. The DO probe uses potassium chloride (KCl) solution contained within a membrane. This membrane and solution should be changed as part of daily calibration procedures. If a bubble is present behind the membrane, if the solution is not present, or if the solution has not been recently changed, accurate DO readings will not be obtained, and the membrane and solution will require replacement. For calibration, place the probe in its storage/calibration chamber within the instrument housing. Using the calibration mode, the instrument is self-calibrating. Calibrations should be recorded in a field notebook or on field calibration forms.

5.5 Equipment Deficiency/Operational Status Reporting

All calibrations will be recorded in a field notebook. These calibration records become part of the individual project files as documentation of the attainment of QA objectives.

6.0 PREVENTATIVE MAINTENANCE

6.1 Routine Maintenance

HRP personnel routinely maintain field equipment for optimal results. All maintenance procedures are documented in control logbooks designated for each piece of equipment. Any field activities involving routine maintenance will be recorded in field logbooks by the individual performing the adjustment of the equipment. Maintenance performed at an authorized repair service will be documented in the maintenance log, including service location, specific repair, and method of transport. Methods of routine maintenance depend on the instrument and manufacturer. The manufacturers' operations manuals will be the primary source of information for these procedures.

6.2 Documentation

Field Services Managers maintain all documentation concerning routine maintenance and non-routine repairs. All pertinent information regarding instrument status is recorded in personnel field log books along with calibration documentation.

6.3 Contingency

In the event that the primary field equipment is inoperable as determined by calibration difficulties, back-up field instruments will be obtained from other sources. These instruments will be calibrated prior to recording data. In no event shall instruments be used to record data unless the performance of the equipment has been documented.

7.0 REFERENCES FOR FIELD SCREENING METHODS

New York State Department of Environmental Conservation (NYSDEC). 2010. "DER-10, Technical Guidance for Site Investigation and Remediation", Division of Environmental Remediation. May 2010.

NYSDEC. Technical Procedural Guidance, Equipment Training, Calibration, and Maintenance, “Spill Guidance Manual” Section 2.2.

USEPA. 2017. “Standard Operating Procedure Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction potential [ORP], and turbidity)”, USEPA, Region 1, Quality Assurance Unit, Revision Number 3, Revised March 23, 2017.

APPENDIX B
TARGET COMPOUND LISTS and CONTRACT-REQUIRED QUANTITATION LIMITS

From: ***NYSDEC ANALYTICAL SERVICE PROTOCOL***
(NYSDEC. 2005. Analytical Service Protocol, July 2005.)

EXHIBIT C

TARGET COMPOUND LISTS (TCLs)

AND

CONTRACT REQUIRED QUANTITATION LIMITS (CRQLs)

PART I - SUPERFUND-CLP ORGANICS
and
PART II - SUPERFUND-CLP INORGANICS

<u>INTRODUCTION</u>

NOTE: *The values in these tables are minimum quantitation limits, <u>not</u> absolute detection limits. The amount of material necessary to produce a detector response that can be <u>identified and reliably quantified</u> is greater than that needed to simply be detected above the background noise. Most of the quantitation limits in these tables are set at the concentrations in the sample equivalent to the concentration of the lowest calibration standard analyzed for each analyte.*

Specific quantitation limits are highly matrix dependent. It is expected that the laboratory make every effort possible to meet the quantitation limits listed herein but it is realized that these limits may not be achievable in all instances.

CRQL values listed on the following pages are based on the analysis of samples according to the specifications given in Exhibit D. Modifications to the sample amounts processed may deviate from those listed in Exhibit D, as long as the limits listed herein can still be achieved.

All CRQL values are rounded to two significant figures.

The term “Solids” is used to denote the following matrices: soil, sediment, sludge, tissue, ash, oil, or mixed phase samples.

CRQL values listed for solids (soil, sediments, etc., except for tissue) are all based on 100% solids content. The quantitation limits calculated by the Laboratory for soil/sediment, calculated on dry weight basis, as required by the Protocol, will be higher. Results for tissue samples should be reported on a wet weight basis, along with their Percent lipid (% Lipid) content.

Changes to the Organic Target Compound Lists (TCLs) (e.g. adding an additional analyte) or lower CRQLs may be requested under the flexibility clause in the contract.

PART I – SUPERFUND-CLP ORGANICS

Volatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Aqueous Samples

	Volatile Analyte	CAS Number	Trace Water By SIM (µg/L)	Trace Level Water (µg/L)	Low Level Water (µg/L)
1.	Dichlorodifluoromethane	75-71-8		0.50	5.0
2.	Chloromethane	74-87-3		0.50	5.0
3.	Vinyl Chloride	75-01-4		0.50	5.0
4.	Bromomethane	74-83-9		0.50	5.0
5.	Chloroethane	75-00-3		0.50	5.0
6.	Trichlorofluoromethane	75-69-4		0.50	5.0
7.	1,1-Dichloroethene	75-35-4		0.50	5.0
8.	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1		0.50	5.0
9.	Acetone	67-64-1		5.0	10.0
10.	Carbon Disulfide	75-15-0		0.50	5.0
11.	Methyl Acetate	79-20-9		0.50	5.0
12.	Methylene chloride	75-09-2		0.50	5.0
13.	trans-1,2-Dichloroethene	156-60-5		0.50	5.0
14.	Methyl tert-Butyl Ether	1634-04-4		0.50	5.0
15.	1,1-Dichloroethane	75-34-3		0.50	5.0
16.	cis-1,2-Dichloroethene	156-59-2		0.50	5.0
17.	2-Butanone	78-93-3		5.0	10.0
18.	Bromochloromethane	74-97-5		0.50	5.0
19.	Chloroform	67-66-3		0.50	5.0
20.	1,1,1-Trichloroethane	71-55-6		0.50	5.0
21.	Cyclohexane	110-82-7		0.50	5.0
22.	Carbon tetrachloride	56-23-5		0.50	5.0
23.	Benzene	71-43-2		0.50	5.0
24.	1,2-Dichloroethane	107-06-2		0.50	5.0
25.	1,4-Dioxane	123-91-1	1.0	25	125
26.	Trichloroethane	79-01-6		0.50	5.0

Volatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Aqueous Samples (Continued)

	Volatile Analyte	CAS Number	Trace Water By SIM (µg/L)	Trace Level Water (µg/L)	Low Level Water (µg/L)
27.	Methylcyclohexane	108-87-2		0.50	5.0
28.	1,2-Dichloropropane	78-87-5		0.50	5.0
29.	Bromodichloromethane	75-27-4		0.50	5.0
30.	cis-1,3-Dichloropropene	10061-01-5		0.50	5.0
31.	4-methyl-2-pentanone	108-10-1		5.0	10.0
32.	Toluene	108-88-3		0.50	5.0
33.	Trans-1,3-Dichloropropene	10061-02-6		0.50	5.0
34.	1,1,2-Trichloroethane	79-00-5		0.50	5.0
35.	Tetrachloroethene	127-18-4		0.50	5.0
36.	2-Hexanone	591-78-6		5.0	10.0
37.	Dibromochloromethane	124-48-1		0.50	5.0
38.	1,2-Dibromoethane	106-93-4	0.05	0.50	5.0
39.	Chlorobenzene	108-90-7		0.50	5.0
40.	Ethylbenzene	100-41-4		0.50	5.0
41.	Xylenes (Total)	1330-20-7		0.50	5.0
42.	Styrene	100-42-5		0.50	5.0
43.	Bromoform	75-25-2		0.50	5.0
44.	Isopropylbenzene	98-82-8		0.50	5.0
45.	1,1,2,2-Tetrachloroethane	79-34-5		0.50	5.0
46.	1,3-Dichlorobenzene	541-73-1		0.50	5.0
47.	1,4-Dichlorobenzene	106-46-7		0.50	5.0
48.	1,2-Dichlorobenzene	95-50-1		0.50	5.0
49.	1,2-Dibromo-3-chloropropane	96-12-8	0.05	0.50	5.0
50.	1,2,4-Trichlorobenzene	120-82-1		0.50	5.0
51.	1,2,3-Trichlorobenzene	87-61-6		0.50	5.0

Volatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Solid Samples

	Volatile Analyte	CAS Number	Low Level Soil (µg/Kg)	Med. Level Soil (µg/Kg)
1.	Dichlorodifluoromethane	75-71-8	5.0	500
2.	Chloromethane	74-87-3	5.0	500
3.	Vinyl Chloride	75-01-4	5.0	500
4.	Bromomethane	74-83-9	5.0	500
5.	Chloroethane	75-00-3	5.0	500
6.	Trichlorofluoromethane	75-69-4	5.0	500
7.	1,1-Dichloroethene	75-35-4	5.0	500
8.	1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	5.0	500
9.	Acetone	67-64-1	10.0	1000
10.	Carbon Disulfide	75-15-0	5.0	500
11.	Methyl Acetate	79-20-9	5.0	500
12.	Methylene chloride	75-09-2	5.0	500
13.	trans-1,2-Dichloroethene	156-60-5	5.0	500
14.	Methyl tert-Butyl Ether	1634-04-4	5.0	500
15.	1,1-Dichloroethane	75-34-3	5.0	500
16.	cis-1,2-Dichloroethene	156-59-2	5.0	500
17.	2-Butanone	78-93-3	10.0	1000
18.	Bromochloromethane	74-97-5	5.0	500
19.	Chloroform	67-66-3	5.0	500
20.	1,1,1-Trichloroethane	71-55-6	5.0	500
21.	Cyclohexane	110-82-7	5.0	500
22.	Carbon tetrachloride	56-23-5	5.0	500
23.	Benzene	71-43-2	5.0	500
24.	1,2-Dichloroethane	107-06-2	5.0	500
25.	1,4-Dioxane	123-91-1	125	12500
26.	Trichloroethane	79-01-6	5.0	500
27.	Methylcyclohexane	108-87-2	5.0	500
28.	1,2-Dichloropropane	78-87-5	5.0	500

Volatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Solid Samples (Continued)

	Volatile Analyte	CAS Number	Low Level Soil (µg/Kg)	Med. Level Soil (µg/Kg)
29.	Bromodichloromethane	75-27-4	5.0	500
30.	cis-1,3-Dichloropropene	10061-01-5	5.0	500
31.	4-methyl-2-pentanone	108-10-1	10.0	1000
32.	Toluene	108-88-3	5.0	500
33.	Trans-1,3-Dichloropropene	10061-02-6	5.0	500
34.	1,1,2-Trichloroethane	79-00-5	5.0	500
35.	Tetrachloroethene	127-18-4	5.0	500
36.	2-Hexanone	591-78-6	10.0	1000
37.	Dibromochloromethane	124-48-1	5.0	500
38.	1,2-Dibromoethane	106-93-4	5.0	500
39.	Chlorobenzene	108-90-7	5.0	500
40.	Ethylbenzene	100-41-4	5.0	500
41.	Xylenes (Total)	1330-20-7	5.0	500
42.	Styrene	100-42-5	5.0	500
43	Bromoform	75-25-2	5.0	500
44.	Isopropylbenzene	98-82-8	5.0	500
45.	1,1,2,2-Tetrachloroethane	79-34-5	5.0	500
46.	1,3-Dichlorobenzene	541-73-1	5.0	500
47.	1,4-Dichlorobenzene	106-46-7	5.0	500
48.	1,2-Dichlorobenzene	95-50-1	5.0	500
49.	1,2-Dibromo-3-chloropropane	96-12-8	5.0	500
50.	1,2,4-Trichlorobenzene	120-82-1	5.0	500
51.	1,2,3-Trichlorobenzene	87-61-6	5.0	500

Semivolatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Aqueous Samples

	Semivolatile Analyte	CAS Number	Low Water By SIM[1] (µg/L)	Water (µg/L)
1.	Benzaldehyde	100-52-7		5.0
2.	Phenol	108-95-2	0.10	5.0
3.	Bis-(2-chlorothyl) ether	111-44-4		5.0
4.	2-Chlorophenol	95-57-8	0.10	5.0
5.	2-Methylphenol	95-48-7	0.10	5.0
6.	2,2'-Oxybis (1-chloropropane)[3]	108-60-1		5.0
7.	Acetophenone	98-86-2		5.0
8.	4-Methylphenol	106-44-5	0.10	5.0
9.	N-Nitroso-di-n-propylamine	621-64-7		5.0
10.	Hexachloroethane	67-72-1		5.0
11.	Nitrobenzene	98-95-3		5.0
12.	Isophorone	78-59-1		5.0
13.	2-Nitrophenol	88-75-5	0.10	5.0
14.	2,4-Dimethylphenol	105-67-9	0.10	5.0
15.	Bis (2-chloroethoxy) methane	111-91-1		5.0
16.	2,4-Dichlorophenol	120-83-2	0.10	5.0
17.	Naphthalene	91-20-3	0.10	5.0
18.	4-Chloroaniline	106-47-8		5.0
19.	Hexachlorobutadiene	87-68-3		5.0
20.	Caprolactam	105-60-2		5.0
21.	4-Chloro-3-methylphenol	59-50-7	0.10	5.0
22.	2-Methylnaphthalene	91-57-6		5.0
23.	Hexachlorocyclopentadiene	77-47-4		5.0
24.	2,4,6-Trichlorophenol	88-06-2	0.10	5.0
25.	2,4,5-Trichlorophenol[4]	95-95-4	0.20	10.0
26.	1,1'-Biphenyl	92-52-4		5.0
27.	2-Chloronaphthalene	91-58-7		5.0

Semivolatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Aqueous Samples (Continued)

	Semivolatile Analyte	CAS Number	Low Water By SIM[1] (µg/L)	Water (µg/L)
28.	2-Nitroaniline[4]	88-74-4		10.0
29.	Dimethylphthalate	131-11-3		5.0
30.	2,6-Dinitrotoluene	606-20-2		5.0
31.	Acenaphthylene	208-96-8	0.10	5.0
32.	3-Nitroaniline[4]	99-09-2		10.0
33.	Acenaphthene	83-32-9	0.10	5.0
34.	2,4-Dinitrophenol[4]	51-28-5	0.20	10.0
35.	4-Nitrophenol[4]	100-02-7	0.20	10.0
36.	Dibenzofuran	132-64-9		5.0
37.	2,4-Dinitrotoluene	121-14-2		5.0
38.	Diethylphthalate	84-66-2		5.0
39.	Fluorene	86-73-7	0.10	5.0
40.	4-Chlorophenyl-phenyl ether	7005-72-3		5.0
41.	4-Nitroaniline[4]	100-01-6		10.0
42.	4,6-Dinitro-2-methylphenol[4]	534-52-1	0.20	10.0
43.	N-Nitrosodiphenylamine	86-30-6		5.0
44.	1,2,4,5-Tetrachlorobenzene	95-34-3		5.0
45.	4-Bromophenyl-phenylether	101-55-3		5.0
46.	Hexachlorobenzene	100-52-7		5.0
47.	Atrazine	108-95-2	0.10	5.0
48.	Pentachlorophenol	111-44-4	0.20	10.0
49.	Phenanthrene	95-57-8	0.10	5.0
50.	Anthracene	95-48-7	0.10	5.0
51.	Carbazole	108-60-1		5.0
52.	Di-n-butylphthalate	98-86-2		5.0

Semivolatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Aqueous Samples (Continued)

	Semivolatile Analyte	CAS Number	Low Water By SIM[1] (µg/L)	Water (µg/L)
53.	Fluoroanthene	106-44-5	0.10	5.0
54.	Pyrene	621-64-7		5.0
55.	Butylbenzylphthalate	67-72-1		5.0
56.	3,3'-Dichlorobenzidine	98-95-3		5.0
57.	Benzo (a) anthracene	78-59-1		5.0
58.	Chrysene	88-75-5	0.10	5.0
59.	Bis (2-ethylhexyl) phthalate	105-67-9	0.10	5.0
60.	Di-n-octylphthalate	111-91-1		5.0
61.	Benzo (b) fluoranthene	120-83-2	0.10	5.0
62.	Benzo (k) fluoranthene	91-20-3	0.10	5.0
63.	Benzo (a) pyrene	106-47-8		5.0
64.	Indeno (1,2,3-cd) pyrene	87-68-3		5.0
65.	Benzo (a,h) anthracene	105-60-2		5.0
66.	Benzo (g,h,i) perylene	59-50-7	0.10	5.0

Semivolatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Solid Samples

	Semivolatile Analyte	CAS Number	Low Level By SIM[1] (µg/Kg)	Low Level Solids[2] (µg/Kg)	Med. Level Solids[2] (µg/Kg)
1.	Benzaldehyde	100-52-7		170	50000
2.	Phenol	108-95-2	3.3	170	50000
3.	Bis-(2-chlorothyl) ether	111-44-4		170	50000
4.	2-Chlorophenol	95-57-8	3.3	170	50000
5.	2-Methylphenol	95-48-7	3.3	170	50000
6.	2,2'-Oxybis (1-chloropropane)[3]	108-60-1		170	50000
7.	Acetophenone	98-86-2		170	50000
8.	4-Methylphenol	106-44-5	3.3	170	50000
9.	N-Nitroso-di-n-propylamine	621-64-7		170	50000
10.	Hexachloroethane	67-72-1		170	50000
11.	Nitrobenzene	98-95-3		170	50000
12.	Isophorone	78-59-1		170	50000
13.	2-Nitrophenol	88-75-5	3.3	170	50000
14.	2,4-Dimethylphenol	105-67-9	3.3	170	50000
15.	Bis (2-chloroethoxy) methane	111-91-1		170	50000
16.	2,4-Dichlorophenol	120-83-2	3.3	170	50000
17.	Naphthalene	91-20-3	3.3	170	50000
18.	4-Chloroaniline	106-47-8		170	50000
19.	Hexachlorobutadiene	87-68-3		170	50000
20.	Caprolactam	105-60-2		170	50000
21.	4-Chloro-3-methylphenol	59-50-7	3.3	170	50000
22.	2-Methylnaphthalene	91-57-6		170	50000
23.	Hexachlorocyclopentadiene	77-47-4		170	50000
24.	2,4,6-Trichlorophenol	88-06-2	3.3	170	50000

Semivolatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Solid Samples (Continued)

	Semivolatile Analyte	CAS Number	Low Level By SIM[1] (µg/Kg)	Low Level Solids[2] (µg/Kg)	Med. Level Solids[2] (µg/Kg)
25.	2,4,5-Trichlorophenol[4]	95-95-4	6.7	330	100000
26.	1,1'-Biphenyl	92-52-4		170	50000
27.	2-Chloronaphthalene	91-58-7		170	50000
28.	2-Nitroaniline[4]	88-74-4		330	100000
29.	Dimethylphthalate	131-11-3		170	50000
30.	2,6-Dinitrotoluene	606-20-2		170	50000
31.	Acenaphthylene	208-96-8	3.3	170	50000
32.	3-Nitroaniline[4]	99-09-2		330	100000
33.	Acenaphthene	83-32-9	3.3	170	50000
34.	2,4-Dinitrophenol[4]	51-28-5	6.7	330	100000
35.	4-Nitrophenol[4]	100-02-7	6.7	330	100000
36.	Dibenzofuran	132-64-9		170	50000
37.	2,4-Dinitrotoluene	121-14-2		170	50000
38.	Diethylphthalate	84-66-2		170	50000
39.	Fluorene	86-73-7	3.3	170	50000
40.	4-Chlorophenyl-phenyl ether	7005-72-3		170	50000
41.	4-Nitroaniline[4]	100-01-6		330	100000
42.	4,6-Dinitro-2-methylphenol[4]	534-52-1	6.7	330	100000
43.	N-Nitrosodiphenylamine	86-30-6		170	50000
44.	1,2,4,5-Tetrachlorobenzene	95-34-3		170	50000
45.	4-Bromophenyl-phenylether	101-55-3		170	50000
46.	Hexachlorobenzene	118-74-1		170	10000
47.	Atrazine	1912-24-9		170	50000
48.	Pentachlorophenol	87-86-5	6.7	330	100000

Semivolatiles Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) for Solid Samples (Continued)

	Semivolatile Analyte	CAS Number	Low Level By SIM[1] (µg/Kg)	Low Level Solids[2] (µg/Kg)	Med. Level Solids[2] (µg/Kg)
49.	Phenanthrene	85-01-8	3.3	170	50000
50.	Anthracene	120-12-7	3.3	170	50000
51.	Carbazole	86-74-8		170	50000
52.	Di-n-butylphthalate	84-74-2		170	50000
53.	Fluoroanthene	206-44-0	3.3	170	50000
54.	Pyrene	129-00-0	3.3	170	50000
55.	Butylbenzylphthalate	85-68-7		170	50000
56.	3,3'-Dichlorobenzidine	91-94-1		170	50000
57.	Benzo (a) anthracene	56-55-3	3.3	170	50000
58.	Chrysene	218-01-9	3.3	170	50000
59.	Bis (2-ethylhexyl) phthalate	117-81-7		170	50000
60.	Di-n-octylphthalate	117-84-0		170	50000
61.	Benzo (b) fluoranthene	205-99-2	3.3	170	50000
62.	Benzo (k) fluoranthene	207-08-9	3.3	170	50000
63.	Benzo (a) pyrene	50-32-8	3.3	170	50000
64.	Indeno (1,2,3-cd) pyrene	193-39-5	3.3	170	50000
65.	Benzo (a,h) anthracene	53-70-3	3.3	170	50000
66.	Benzo (g,h,i) perylene	191-24-2	3.3	170	50000

Semivolatile Notes

[1] CRQLs for optional analysis of water and soil samples using SIM (Selected Ion Monitoring) techniques for PAHs and phenols.

[2] Denotes soil, sediment, tissue, or mixed phase samples.

[3] Previously known as bis (2-Chloroisoproply) ether.

[4] Seven semivolatile compounds are calibrated using only a four point initial calibration, eliminating the lowest standard. Therefore, the CRQL values for these eight compounds are 2 times higher for all matrices and levels.

Pesticide Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) For Aqueous and Solid Samples

	Pesticide Analyte	CAS Number	Water (µg/L)	Solids[1] (µg/Kg)
1.	alpha-BHC	319-84-6	0.050	1.7
2.	beta-BHC	319-85-7	0.050	1.7
3.	delta-BHC	319-86-8	0.050	1.7
4.	gamma-BHC (Lindane)	58-89-9	0.050	1.7
5.	Heptachlor	76-44-8	0.050	1.7
6.	Aldrin	309-00-2	0.050	1.7
7.	Heptachlor epoxide[2]	1024-57-3	0.050	1.7
8.	Endosulfan I	959-98-8	0.050	1.7
9.	Dieldrin	60-57-1	0.10	3.3
10.	4,4'-DDE	72-55-9	0.10	3.3
11.	Endrin	72-20-8	0.10	3.3
12.	Endosulfan II	33213-65-9	0.10	3.3
13.	4,4'-DDD	72-54-8	0.10	3.3
14.	Endosulfan sulfate	1031-07-8	0.10	3.3
15.	4,4'-DDT	50-29-3	0.10	3.3
16.	Methoxychlor	72-43-5	0.10	3.3
17.	Endrin ketone	53494-70-5	0.10	3.3
18.	Endrin aldehyde	7421-93-4	0.10	3.3
19.	alpha-Chlordane	5103-71-9	0.050	1.7
20.	gamma-Chlordane	5103-74-2	0.050	1.7
21.	Toxaphene	8001-35-2	5.0	34

Pesticide Notes

[1] There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of pesticides.

[2] Only the exo-epoxy isomer (isomer B) of heptachlor epoxide is reported on the data reporting forms (Exhibit B).

PCB Aroclor Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) For Aqueous and Solid Samples

	Aroclor Analyte	CAS Number	Water (µg/L)	Solids[1] (µg/Kg)
1.	Arochlor-1016	12674-11-2	1.0	33
2.	Arochlor-1221	11104-28-2	1.0	33
3.	Arochlor-1232	11141-16-5	1.0	33
4.	Arochlor-1242	53469-21-9	1.0	33
5.	Arochlor-1248	12672-29-6	1.0	33
6.	Arochlor-1254	11097-69-1	1.0	33
7.	Arochlor-1260	11096-82-5	1.0	33
8.	Arochlor-1262	37324-23-5	1.0	33
9.	Arochlor-1268	11100-14-4	1.0	33

Aroclor PCB Notes

[1] There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of Aroclor PCBs.

PCB Congeners Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) For Aqueous and Solid Samples

	Congener Analyte	IUPAC Number	CAS Number	Water (pg/L)	Solids[1] (ng/Kg)
1.	2-MoCB	1	2051-60-7	20	2.0
2.	4-MoCB	3	2051-62-9	20	2.0
3.	2,2'-DiCB	4	13029-08-8	20	2.0
4.	4,4'-DiCB	15	2050-68-2	20	2.0
5.	2,2',6'-TrCB	19	38444-73-4	20	2.0
6.	3,4,4'-TrCB	37	38444-90-5	20	2.0
7.	2,2',6,6'-TeCB	54	15968-05-5	20	2.0
8.	3,3',4,4'-TeCB	77	32598-13-3	20	2.0
9.	3,4,4',5-TeCB	81	70362-50-4	20	2.0
10.	2,2',4,6,6'-PeCB	104	56558-16-8	20	2.0
11.	2,3,3',4,4'-PeCB	105	32598-14-4	20	2.0
12.	2,3,4,4',5-PeCB	114	74472-37-0	20	2.0
13.	2,3',4,4',5-PeCB	118	31508-00-6	20	2.0
14.	2',3,4,4',5-PeCB	123	65510-44-3	20	2.0
15.	3,3',4,4',5-PeCB	126	57465-28-8	20	2.0
16.	2,2',4,4',6,6'-HxCB	155	33979-03-2	20	2.0
17.	2,3,3',4,4',5-HxCB	156	38380-08-4	20	2.0
18.	2,3,3',4,4',5'-HxCB	157	69782-90-7	20	2.0
19.	2,3',4,4',5,5'-HxCB	167	52663-72-6	20	2.0
20.	3,3',4,4',5,5'-HxCB	169	32774-16-6	20	2.0
21.	2,2',3,4',5,6,6'-HpCB	188	74487-85-7	20	2.0
22.	2,2',3,4',5,6,6'-HpCB	189	39635-31-9	20	2.0
23.	2,2',3,3',5,5',6,6'-OcCB	202	2136-99-4	20	2.0
24.	2,3,3',4,4',5,5',6-OcCB	205	74472-53-0	20	2.0
25.	2,2',3,3',4,4',5,5',6-NoCB	206	40186-72-9	20	2.0

PCB Congeners Target Compound List (TCL) and Contract Required Quantitation Limits (CRQL) For Aqueous and Solid Samples (Continued)

	Congener Analyte	IUPAC Number	CAS Number	Water (pg/L)	Solids[1] (ng/Kg)
26.	2,2',3,3',4,5,5',6,6'-NoCB	208	52663-77-1	20	2.0
27.	DeCB	209	2051-24-3	20	2.0

<u>Congener PCB Notes</u>

[1]There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of congener PCBs.

PCDD/F Target Compound List (TCL) and
Contract Required Quantitation Limits (CRQL)
For Aqueous and Solid Samples

	PCDD/F Analyte	CAS Number	Water (pg/L)	Solids[1] (ng/Kg)
1.	2,3,7,8-TCDD	1746-01-6	10	1.0
2.	1,2,3,7,8-PeCDD	40321-76-4	50	5.0
3.	1,2,3,6,7,8-HxCDD	57653-85-7	50	5.0
4.	1,2,3,4,7,8-HxCDD	39227-28-6	50	5.0
5.	1,2,3,7,8,9-HxCDD	19408-74-3	50	5.0
6.	1,2,3,4,6,7,8-HpCDD	35822-46-9	50	5.0
7.	OCDD	3268-87-9	100	10
8.	2,3,7,8-TCDF	51207-31-9	10	1.0
9.	1,2,3,7,8-PeCDF	57117-41-6	50	5.0
10.	2,3,4,7,8-PeCDF	57117-31-4	50	5.0
11.	1,2,3,6,7,8-HxCDD	57117-44-9	50	5.0
12.	1,2,3,7,8,9-HxCDD	72918-21-9	50	5.0
13.	1,2,3,4,7,8-HxCDD	70648-26-9	50	5.0
14.	2,3,4,6,7,8-HxCDD	60851-34-5	50	5.0
15.	1,2,3,4,6,7,8-HpCDD	67562-39-4	50	5.0
16.	1,2,3,4,7,8,9-HpCDD	55673-89-7	50	5.0
17.	OCDF	39001-02-0	100	10

PCDD/F Notes

[1] There is no differentiation between the preparation of low and medium soil samples in this method for the analysis of PCDDs and PCDFs.

Total PCDD/F Homologues

Data are reported for the total concentration of all detected chlorinated dibenzo-p-dioxins (CDD) or chlorinated dibenzofurans (CDF's) in the following homologues. However, because the number of non-2,3,7,8-substituted isomers that might be detected in a sample is unpredictable, it is not possible to assign Contract Required Quantitation Limits (CRQLs) values to the total homologue concentrations.

PCDD/F Homologue	CAS Number	No. of Possible Isomers	No. of 2,3,7,8-Substituted Isomers
Total TCDD	41903-57-5	22	1
Total PeCDD	36088-22-9	14	1
Total HxCDD	34465-46-8	10	3
Total HpCDD	37871-00-4	2	1
Total TCDF	55722-27-5	38	1
Total PeCDF	30402-15-4	28	2
Total HxCDD	55684-94-1	16	4
Total HpCDD	38998-75-3	4	2

There is only one isomer in both the OCDD on OCDF homologues, hence the total concentration is the same as the 2,3,7,8-substituted concentration.

Homologue	Definition
TCDD	Tetrachlorinated dibenzo-p-dioxin
PeCDD	Pentachlorinated dibenzo-p-dioxin
HxCDD	Hexachlorinated dibenzo-p-dioxin
HpCDD	Heptachlorinated dibenzo-p-dioxin
OCDD	Octachlorinated dibenzo-p-dioxin
TCDF	Tetrachlorinated dibenzofuran
PeCDF	Pentachlorinated dibenzofuran
HxCDD	Hexachlorinated dibenzofuran
HpCDD	Heptachlorinated dibenzofuran
OCDF	Octachlorinated dibenzofuran

PART II – SUPERFUND-CLP INORGANICS

Inorganic Target Compound List (TCL) and Contract Required Quantitation Limits (CRQLs) For Aqueous and Solid Samples

	Analyte	CAS Number	ICP-AES[1] CRQL for Water (µg/L)	ICP-AES[1] CRQL for Solids (mg/Kg)	ICP-MS[1] for Water (µg/L)
1.	Aluminum	7429-90-5	200	40	30
2.	Antimony	7440-36-0	60	12	2
3.	Arsenic	7440-38-2	15	3	1
4.	Barium	7440-39-3	200	40	10
5.	Beryllium	7440-41-7	5	1	1
6.	Cadmium	7440-43-9	5	1	1
7	Calcium	7440-70-2	5000	1000	--
8.	Chromium	7440-47-3	10	2	2
9.	Cobalt	7440-48-4	50	10	0.5
10.	Copper	7440-50-8	25	5	2
11.	Iron	7439-89-6	100	20	--
12.	Lead	7439-92-1	10	2	1
13.	Magnesium	7439-95-4	5000	1000	--
14.	Manganese	7439-96-5	15	3	0.5
15.	Mercury[2]	7439-97-6	0.2	0.1	--
16.	Nickel	7440-02-0	40	8	1
17.	Potassium	7440-09-7	5000	1000	--
18.	Selenium	7782-49-2	35	7	5
19.	Silver	7440-22-4	10	2	1
20.	Sodium	7440-23-5	5000	1000	--
21.	Thallium	7440-28-0	25	5	1
22.	Vanadium	7440-62-2	50	10	1
23.	Zinc	7440-66-6	60	12	1
24.	Cyanide[2]	57-12-5	10	1	--

Inorganic Notes

[1] Any analytical method specified in Exhibit D, may be utilized as long as the documented instrument or method detection limits (IDLs or MDLs) are less than one half the Contract Required Quantitation Level (CRQL) requirements. Higher quantitation levels may only be used in the following circumstance:

If the sample concentration exceeds five times the quantitation limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the Contract Required Quantitation Limit. This is illustrated in the example below:

> For lead:
> Method in use = ICP
> Instrument Detection Limit (IDL) = 40
> Sample concentration = 220
> Contract Required Quantitation Level (CRQL) = 3

The value of 220 may be reported even though instrument detection limit is greater than Contract Required Quantitation Limit. The instrument or method detection limit must be documented as described in Exhibit E.

[2] Mercury is analyzed by cold vapor atomic absorption. Cyanide is analyzed by colorimetry/spectrophotometry.

APPENDIX G

Site Management Forms

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.

	Current Reporting Period	**Total to Date**
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (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.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
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.

	Current Reporting Period (miles)	**Total to Date (miles)**
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.

	Current Reporting Period (gallons)	**Total to Date (gallons)**
Total quantity of water used on-site		
Of that total amount, provide quantity:		
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).

	Current Reporting Period (acres)	**Total to Date (acres)**
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.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR
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. ____ **Date** **Contractor**

Active Industrial
NYSDEC Site No. 152125
Site Activities Log

63 West Montauk Highway
Lindenhurst, NY

Personnel On-Site	Date/Time On-Site	Time Off-Site	Reason For Site Visit (Check Box Below)			
				Monitoring		Maintenance
				Sampling		Other (Provide Description)
				Alarm Response		
Description:						

Personnel On-Site	Date/Time On-Site	Time Off-Site	Reason For Site Visit (Check Box Below)			
				Monitoring		Maintenance
				Sampling		Other (Provide Description)
				Alarm Response		
Description:						

Personnel On-Site	Date/Time On-Site	Time Off-Site	Reason For Site Visit (Check Box Below)			
				Monitoring		Maintenance
				Sampling		Other (Provide Description)
				Alarm Response		
Description:						

Fire Safety Inspection Log
Active Industrial Uniform Site
NYSDEC Site No. 152125
63 West Merrick Road, Lindenhurst, NY

Monthly Fire Safety Inspection Items			
Item	**Description**	**Result**	
1	Exit signs internally or externally illuminated	Yes	No
2	Smoke alarms tested and functioning	Yes	No
3	Water leaks/water damage observed inside building	Yes	No
4	Fire extinguishers within expiration or inspected annually	Yes	No
5	All fire extinguishers present	Yes	No
6	Electrical Breaker Panel Issues	Yes	No
7	Covers present on all junction boxes, electrical switches, and outlets	Yes	No
8	Any evidence of pests present inside building (rodents, insects, etc.)	Yes	No
9	Emergency lighting tested and functioning	Yes	No

Periodic System Testing and Inspection				
Item	**Description**	**Frequency**	**Date Last Performed**	**Date Due**
10	Sprinkler system testing	Annual		
11	Battery powered emergency lighting tested	Annual		
12	Fire Extinguishers annual inspection	Annual		
13	Emergency Lighting Testing	Monthly		

Inspected By:
Inspection Date:

Other Items Noted:

Monitor Well Data Sheet

Well ID:

Site Background Information

Site Location:		**Sampling Dates:**	
Job Number:		**Field Team Leader:**	
Weather:		**Team Personnel:**	

Ground Water Elevation Data

Date	Time	Sampler Name	Equipment Model		Depth to Water (ft)		Depth to Bottom (ft)	
			Solinst-101		uncorrected		uncorrected	
			corr. factor	0	corrected		corrected	

Measurement Point: PVC

Well Condition

General Condition	Visible Well ID	Well Cap Present	Well Plumbness	Lock

Concrete Collar	Ponded Water	Comments:

Well Purging Data

Date	Time						Sampler Initials	Instrument Calibration Date
	Equipment Set-up		Purging		Sample Collection			
	Start	Finish	Start	Finish	Start	Finish		

	Instrument Mfg & Model
pH	YSI-600XL sn#
Temp.	
Sp. Cond.	
ORP	
DO	
Turbidity	HF Scientific DRT-15CE sn#

Initial Water Depth (ft):				Time:				
Time	Water Depth (ft)	Flow Rate (ml/min)	pH (s.u.)	Temp (^oC)	Sp Con (uS)	ORP (mV)	DO (mg/l)	Turbidity (ntu)
Req. Limits for Last 3 Readings			0.1	3%	3%	10mV	10% or <0.5	10% or <5.0

Pump Mfg & Model	Color	Odor	Purge Vol (ml)	Sample Depth (ft.)
GeoTech Peristaltic Pump				

Sample Containers

Type & No.	Volume	Preservative

Type & No.	Volume	Preservative

Report No. **(Site Name) - NYSDEC Site No.** Date:

NYSDEC Division of Environmental Remediation				**NYSDEC Contract No. D011107** Superintendent: NYSDEC PM: Consultant PM: Consultant Site Inspectors:
Site Location:				
Weather Conditions				
General Description		AM		PM
Temperature		AM		PM
Wind		AM		PM

Health & Safety
If any box below is checked "Yes", provide explanation under "Health & Safety Comments".

Were there any changes to the Health & Safety Plan?	*Yes	No	NA
Were there any exceedances of the perimeter air monitoring reported on this date?	*Yes	No	NA
Were there any nuisance issues reported/observed on this date?	*Yes	No	NA

Health & Safety Comments

Summary of Work Performed	Arrived at site:		Departed Site:	

Equipment/Material Tracking
If any box below is checked "Yes", provide explanation under "Material Tracking Comments".

Were there any vehicles which did not display proper D.O.T numbers and placards?	*Yes	No	NA
Were there any vehicles which were not tarped?	* Yes	No	NA
Were there any vehicles which were not decontaminated prior to exiting the work site?	* Yes	No	NA

Personnel and Equipment

Individual	Company	Trade	Total Hours

Report No. **(Site Name) - NYSDEC Site No.** Date:

Equipment Description	Contractor/Vendor	Quantity	Used

Material Description	Imported/ Delivered to Site	Exported off Site	Waste Profile (If Applicable)	Source or Disposal Facility (If Applicable)	Daily Loads	Daily Weight (tons)*

*On-Site scale for off-site shipment, delivery ticket for material received

Equipment/Material Tracking Comments:

Visitors to Site

Name	Representing	Entered Exclusion/CRZ Zone	
		Yes	No
		Yes	No
		Yes	No
		Yes	No
		Yes	No
		Yes	No
		Yes	No
		Yes	No
		Yes	No

Site Representatives

Name	Representing

Project Schedule Comments

Issues Pending

Interaction with Public, Property Owners, Media, etc.

Include (insert) figures with markups showing location of work and job progress

Site Photographs (Descriptions Below)	

Comments

Site Inspector(s):	**Date:**

DAILY HEALTH CHECKLIST

Is social distancing being practiced?	Yes ☐	No ☐
Is the tail gate safety meeting held outdoors?	Yes ☐	No ☐
Are remote/call in job meetings being held in lieu of meeting in person where possible?	Yes ☐	No ☐
Were personal protective gloves, masks, and eye protection being used?	Yes ☐	No ☐
Are sanitizing wipes, wash stations or spray available?	Yes ☐	No ☐
Have any workers/visitors been excluded based on close contact with individuals diagnosed with COVID-19, have recently traveled to restricted areas or countries, or are symptomatic (fever, chills, cough/shortness of breath)?	Yes ☐	No ☐
Comments:		

REMEDIAL ACTIVITIES AT PROPERTIES

1. Have anyone at this location been tested and confirmed to have COVID-19?	Yes ☐	No ☐
2. Is anyone at this location isolated or quarantined for COVID-19?	Yes ☐	No ☐
3. Has anyone at this locaton had contact with anyone known to have COVID-19 in the past 14 days?	Yes ☐	No ☐
4. Does anyone at this locaton have any symptoms of a respiratory infection (e.g., cough, sore throat, fever, or shortness of breath)?	Yes ☐	No ☐
5. Does the Department and its contractors have your permission to enter the property at this time?	Yes ☐	No ☐
If Yes to any of 1-4 above: • If it is not critical that service/entry be carried out immediately and can be postponed until the risk of COVID-19 is lower, or can be accomplished remotely/without entry, postpone or conduct service without entry. • If it is critical that service/entry be carried out immediately, advise occupants that as a precaution and for our own protection, project personnel will be donning appropriate PPE* (including respiratory protection) - and do so prior to entry.	Yes ☐	No ☐
Comments:		

NUISANCE CHECKLIST

Were there any community complaints related to work on this date?	Yes ☐	No ☐	N/A☐
Were there any odors detected on this date?	Yes ☐	No ☐	N/A☐
Was noise outside specification and/or above background on this date?	Yes ☐	No ☐	N/A☐
Were vibration readings outside specification and/or above background on this date?	Yes ☐	No ☐	N/A☐
Any visible dust observed beyond the work perimeter on this date?	Yes ☐	No ☐	N/A☐
Any visible contrast (turbidity) beyond engineering controls observed on this date?	Yes ☐	No ☐	N/A☐
Was turbidity checked at the Montauk Highway outfall?	AM ☐	PM ☐	N/A☐
Were any property owners NOT provided advance notice for work performed on this property on this date?	Yes ☐	No ☐	N/A☐
Was the temporary fabric structure closed at the end of the day?	Yes ☐	No ☐	N/A☐
Has Contractor failed to protect all foundations and structures adjacent to and adjoining the site which are affected by the excavations or other operations connected with performance of the Work?	Yes ☐	No ☐	N/A☐
If yes, has Contractor been notified?	Yes ☐	No ☐	N/A☐
Comments:			

APPENDIX H

Site-Specific Work Plan

MOVE YOUR ENVIRONMENT FORWARD

SITE-SPECIFIC WORK PLAN

Active Industrial Uniform Superfund Site
63 West Merrick Road
Lindenhurst, New York

NYSDEC Site Number: 152125

Prepared For:

New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233
Contract# D009808

Prepared By:

HRP Associates, Inc.
197 Scott Swamp Road
Farmington, CT 06032

HRP #: DEC1004.OM

Issued On: December 16, 2020

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1.0 INTRODUCTION

On May 6, 2020, HRP Associates, Inc. (HRP) was authorized to proceed with this New York State Department of Environmental Conservation (NYSDEC) Work Assignment (WA) No. 4 (D009808-04) for Remedial System Operations and Maintenance (O&M) and Groundwater Monitoring for the Active Industrial Uniform facility located at 63 West Merrick Road (a.k.a. West Montauk Highway, or State Route 27A) in the Village of Lindenhurst, Suffolk County, New York (hereinafter referred to as the "Site").

1.1 Purpose and Objectives

This site-specific Work Plan is intended to supplement the Site Management Plan (SMP) and describes the details of the scope of work, including all proposed field activities, laboratory analyses, and data QA/QC evaluation that will be performed at the Site.

The scope of work for the O&M and groundwater monitoring portion of the Work Assignment, discussed herein, was developed based on HRP's review of information provided by the NYSDEC on subsurface investigations and remedial activities completed at the property between 1987 and 2019, as well as discussions and planning with NYSDEC staff. The primary objectives of the scope of work are to:

- Conduct periodic groundwater sampling activities to monitor the effectiveness of the remedial activities previously conducted at the Site; and
- Perform site maintenance activities to maintain the appearance of the site and ensure compliance with building and fire safety codes.

1.2 Site Description and Background Information

The Active Industrial Uniform Site is located in the Village of Lindenhurst, Town of Babylon, Suffolk County, New York. The Site location is shown on **Figure 1**. The Site is comprised of three parcels, identified as District 103, Section 22, Block 1, and Lots 9.001, 9.002 and 25 on the Suffolk County Tax Map, with a total area of approximately 0.5 acres. The Site is bounded by West Montauk Highway (aka State Route 27A) to the north, Tompkins Lane and residences to the south, and commercial properties to the east, and west (**Figure 2**).

The Site is currently vacant. Historically, the Site was occupied by a dry cleaner and laundry. The laundering operations were performed at the Site between 1945 and 1993; dry cleaning operations were conducted between 1970 and 1987. In June 1993, the laundering operation ceased, and the facility began operating as a distribution center. In May 1994, all operations of the Site had ceased. In February 1995, the on-site buildings were demolished. The Site currently is improved with a 35'x35' treatment building with associated air stripping towers and carbon vessels. A fence with locked gate surrounds the property. The northern parcel of the Site is zoned Business; the southeastern and southwestern parcels are zoned B Residence.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include light commercial and residential properties. The properties immediately south of the Site include residential properties; the properties immediately north, east, and west of the Site include light commercial properties.

An initial soil and groundwater investigation of the Site was conducted in 1987. A release of chlorinated solvents was identified at the Site associated with the storage and use of dry-cleaning chemicals. Volatile organic compounds (VOCs) were detected in soil and groundwater samples. Three former tetrachloroethylene (PCE) underground storage tanks (USTs) were identified as the source of contamination. In 1991, a soil vapor extraction (SVE) system was installed at the Site.

Active Industrial Uniform entered into an Order of Consent on September 22, 1993 with the NYSDEC to remediate the Site. On March 31, 1999, a Record of Decision (ROD) was issued by the NYSDEC, which outlined the remedial approach for the Site.

Remedial activities at the Site included excavation of the polluted soil, underground storage tanks and drywells; operation of the SVE system (constructed in 1991 and dismantled in 2000); operation of the Groundwater Extraction & Treatment (GWE&T) remedial system; and installation of a sub-slab depressurization (SSD) system off-site at 608 Tompkins Lane.

The GWE&T system, constructed at the Site in 2001, was shut off in 2018 under the approval of the NYSDEC. Currently, on-site activities include quarterly groundwater sampling and landscaping and snow removal as needed.

1.3 Site Geology and Hydrogeology

Long Island's geology is composed of Monmouth Group, Matawan Group and Magothy Formation, which is described as a sequence of unconsolidated glacial, lacustrine, deltaic, and marine deposits of clay, silt, and gravel that range in age from Upper Cretaceous to Pleistocene. These deposits overlay a Precambrian to Paleozoic crystalline bedrock. There is a confining clay layer approximately 70 feet below ground surface (bgs). Based on the previous investigations conducted by others, subsurface soils consist primarily of fine to coarse sand with varying amounts of gravel.

The direction of groundwater flow in the area is predominantly to the south-southwest. The depth to groundwater beneath the Site is approximately 8 to 10 feet bgs. The nearest surface water body is Little Neck Creek, located approximately 800 feet southwest of the Site. The nearest public water supply well, USGS Well # 404124073241601, is located approximately 1.7 miles to the north.

1.4 Environmental Impacts

Numerous investigations have shown that the soil at the Site was contaminated with chlorinated VOCs. The historical on-site dry-cleaning operations caused wide-spread soil and groundwater contamination with PCE and its degradation products. Site-specific chlorinated contaminants of concern include PCE, trichloroethylene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride. Some other VOCs were also reported at the Site, including 1,1,1-trichloroethane (TCA) and trans-1,2-dichloroethylene (trans-1,2-DCE). In addition, petroleum hydrocarbons were also detected in soils associated with the 2,000-gallon UST used for storage of #2 fuel oil and abandoned in place in the 1980s.

The Site underwent several iterations of soil remediation between 1991 and 2011. The most recent soil remediation was conducted in 2010, when the areas of two USTs, drainage features, several drywells, and associated soil were remediated. The excavation area encompassed approximately 4,200 square feet, which included the USTs and drainage features, and extended to 2 to 12 feet bgs.

The groundwater contaminated with chlorinated VOCs was treated via the GWE&T remediation system that operated at the Site between 2001 and 2018. During the most recent sampling event in July 2020, on-site groundwater monitoring wells (MW-104 through MW-106, and MW-4D) exhibited one or more of the site-specific VOCs at concentrations exceeding their respective Class GA Groundwater Standards. It should also be noted that PCE was detected in nine of the ten sampled groundwater monitoring wells at concentrations ranging from 0.41 micrograms per liter (ug/L) in MW-5S to a maximum of 54 ug/L in MW-4D. However, PCE only exceeded the Class GA Standard of 5 ug/L in three of the ten groundwater monitoring wells. Off-site well MW-2S exhibited concentrations of PCE, TCE, vinyl chloride, and/or cis-1,2-DCE above the applicable standards as well. VOCs were not detected in the other off-site wells sampled at concentrations exceeding the applicable standards.

In November 2007 to January 2008, a vapor intrusion investigation of the Site and several off-site structures was performed. Two compounds, PCE and carbon tetrachloride, were reported in indoor air at levels above NYSDOH indoor air guidance values at 608 Tompkins Lane. Due to the results of the investigation, a sub-slab depressurization system was installed in 2009 at the residence located at 608 Tompkins Lane.

2.0 SCOPE OF WORK

This scope of work has been designed to gather data to evaluate each project objective listed in **Section 1.1**. The following sections provide specifics regarding the scope of work developed under this NYSDEC-approved Work Assignment (D009808-04).

2.1 Preliminary Activities

As part of the scope of work, the following documents have been prepared under this Work Assignment:

- Site-specific Work Plan (this document) to accompany the Site Management Plan (SMP).
- Site-specific Health and Safety Plan (HASP) (provided as part of the SMP).
- Generic Quality Assurance Project Plan (QAPP) (provided as part of the SMP).

These NYSDEC-approved generic HASP and QAPP are on file with the NYSDEC. The site-specific elements are provided below.

2.1.1 Work Plan

This Work Plan has been prepared for use in performing the environmental services, and will serve as the site-specific field activities plan. This Work Plan provides a description of the tasks to be performed including the specific methods or procedures that will be used to conduct the field sampling. A proposed project schedule is included in **Section 4.1** of this Work Plan.

2.1.2 Health and Safety Plan

A site-specific Health and Safety Plan (HASP), included in Appendix G the SMP, provides guidance to maximize health and safety of on-site workers during specific tasks including groundwater sampling and monitoring well gauging. The site-specific HASP has guidelines for health and safety supervision, air monitoring, medical monitoring, personal protective equipment, site controls, safe work practices and decontamination, etc.

2.1.3 Quality Assurance Project Plan

A site-specific Quality Assurance Project Plan (QAPP) has been prepared and is included in **Section 3** of this Work Plan. The site-specific QAPP was prepared as a supplement to the Generic QAPP with necessary site-specific information. A copy of the Generic QAPP was provided as Appendix F in the SMP. Deviations from the protocols specified in the QAPP will be subject to the NYSDEC approval.

The Generic QAPP provides general information related to QA/QC procedures associated with the collection and analysis of samples of environmental media and includes specific representative standard operating procedures (SOPs) applicable to sample handling and field instrumentation use. Information provided in the Generic QAPP includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; auditing; data reduction, validation, and reporting; corrective action requirements; and QA/QC reporting specific to the analyses performed by the laboratories that are used for analysis of environmental media collected under Standby Contract No. D009808.

All laboratory analytical work will be performed by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) approved laboratory certified in all categories of Contract Laboratory Protocol (CLP) and Solid and Hazardous Waste analytical testing. A Data Usability Summary Report (DUSR) will be included in the Quarterly O&M and Monitoring Reports for each round of analytical work. Category B deliverables will be retained in the project files and available for full data validation by a qualified, independent third party.

2.2 Environmental Sampling and Implementation

The site work will include the components described below. The number and type of samples to be collected is discussed below and summarized on **Table 1**.

1. Groundwater Monitoring (well gauging and sampling);
2. Analytical Data Quality Evaluation

2.2.1 Groundwater Monitoring

For the purpose of monitoring of the groundwater quality and to ensure the selected remedy was effective, the following groundwater sampling program will be implemented:

- Quarterly sampling (January, April, July, October) of groundwater monitoring wells MW-2S, MW-4D, MW-5S, MW-103, MW-104, MW-105, MW-106, MW-107, RW-1, and RW-2;
- Semi-annual sampling (January and July) of groundwater monitor wells MW-101, MW-102, MW-108, MW-109 and MW-111.

Groundwater samples will be analyzed for VOCs via EPA Method 8260. All groundwater samples will be collected in accordance with low-flow groundwater sampling procedures and will be submitted to Eurofins Test America, an NYSDOH ELAP-certified laboratory, for analysis. Two duplicate samples and two trip blanks will be collected and submitted to the laboratory for analysis.

Depth to water measurements will be collected from all of the site monitoring wells prior to sample collection. Water-quality parameters, specifically pH, conductivity, dissolved oxygen and/or oxidation/reduction potential, temperature, and turbidity (at a minimum) are measured to provide general groundwater quality information. These parameters are also monitored for stability during purging of groundwater monitoring wells. HRP's standard operating procedures (SOP) for field screening will be followed during field screening activities. The SOP can be found in the generic QAPP, included as Appendix F of the SMP document. The locations of each well are presented on **Figure 2**.

2.2.2 Decontamination Procedures

Non-dedicated sampling equipment (i.e., submersible pumps, water level indicators, etc.) will be subject to decontamination procedures prior to each sample collected to reduce the potential for cross-contamination, as described in the Standard Operating Procedures (provided in the generic QAPP). The decontamination procedures will include the use of a scrub wash with a solution consisting of Alconox® detergent and potable water followed by a rinse with DI water. The decontaminated equipment will be stored in clean environments (i.e., the manufacturer's storage case). Decontamination fluids will be properly labeled and securely stored in the designated waste-container staging area.

2.2.3 Disposal of Investigation Derived Waste

Derived waste (DW) that is generated from the purging of monitoring wells shall be handled in accordance with NYSDEC DER-10. HRP will be responsible for supplying the equipment and materials necessary for the proper handling and storage of the DW, such as DOT-approved 55-gallon drums. All containers will be labeled and transported off-site appropriately, following waste characterization.

2.2.4 Analytical Data Quality Evaluation

This Work Plan and the associated site-specific QAPP (**Section 3**) detail the data quality objectives and analytical requirements needed for this WA. All quality assurance protocols will be provided in the Generic QAPP.

During the final Work Plan review period, the site-specific QAPP Section and Work Plan will be reviewed and modified according to NYSDEC requirements and comments. Once the plans are finalized, deviations, if required, from protocols specified in the plans will be approved in advance by NYSDEC. As required, the selected analytical laboratory will maintain NYSDOH ELAP certification in all categories of CLP and Solid and Hazardous Waste analytical testing for the duration of the project.

The selected laboratory will supply all required data deliverables (USEPA CLP and NYSDEC ASP deliverable format) to enable the data to be validated. All environmental data will be submitted electronically in a specified format named 'NYSDEC' in accordance with the data submission procedures outlined on the NYSDEC's web site (http://www.dec.ny.gov/chemical/62440.html).

Upon receipt of the sample data, the validation contractor will quantitatively and qualitatively validate the laboratory data. The validation of the analytical data will be performed according to the protocols and QC requirements of the analytical methods, the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic and Inorganic Data Review (February 1994), the USEPA Region II CLP Data Review SOP, and the reviewer's professional judgment.

2.2.5 GWE&T System O&M Activities

The GWE&T system is currently shut off. The following activities are currently performed in association with the GWE&T system and the Site:

- Biweekly fire/safety inspection and corrective actions, including a corrective actions work plan to bring the site into compliance with local fire codes; and
- Grounds maintenance.

2.3 Reporting

Each monitoring event will be documented and summarized in the quarterly O&M reports. The submitted report will include the report text, figures, photographs, data summary tables, and inspection formsin a PDF format. Reports will be submitted to the NYSDEC electronically.

2.3.1 Electronic Data Delivery

All environmental data will be submitted electronically in a specified Electronic Data Deliverable (EDD) format named in accordance with the data submission procedures outlined on the NYSDEC's web site (http://www.dec.ny.gov/chemical/62440.html).

3.0 SITE-SPECIFIC QUALITY ASSURANCE PROJECT PLAN

This site-specific Quality Assurance Project Plan (QAPP) has been prepared as a companion Section to accompany the Generic QAPP for the standby subcontract prepared by HRP for the New York State Department of Conservation (NYSDEC) under Standby Contract No. D009808. The purpose of the QAPP is to specify QA/QC procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible.

3.1 Site-Specific Sampling

3.1.1 Sample Handling

Groundwater samples will be collected as part of the groundwater monitoring activities. Detailed sampling procedures are included in Section 4.0 of the Generic QAPP (provided as part of the SMP). Matrix types, number of samples (including QA/QC) and analytical details are summarized in **Table 1** (follows text). Groundwater monitoring well locations are depicted on **Figure 2.**

3.2 Data Quality Assessment and Usability

Data quality objectives for the Site are focused towards the monitoring of the groundwater conditions on-site and downgradient of the Site. Data collected will be used to evaluate the efficiency of the previously implemented remedy on-site, while additionally evaluating groundwater conditions that could pose a risk to receptors.

To achieve these objectives, QA/QC measures will be implemented throughout the monitoring activities to provide input as to the validity and usability of data generated through groundwater sampling. The procedures for data QA/QC management includes field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; auditing; data reduction, validation, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratory. **Table 2** lists the sample containers, preservation, and holding time requirements for the parameters specific to this Site. These tables will be referenced by field personnel.

4.0 PROJECT MANAGEMENT

HRP has the responsibility of the overall management of this project and will respond to any NYSDEC requests. A proposed project schedule, key project personnel, and project-specific subcontractors follow.

4.1 Project Schedule and Key Milestones

The proposed project schedule for this work assignment is outlined below. Key milestones are identified to monitor work progress. The following milestones will be applicable for this project:

		Est. Schedule
• Milestone 1:	File Review	Completed
• Milestone 2:	Development of 2.11's	Completed
• Milestone 3:	2.11's submittal and NYSDEC Approval for WA	Completed
• Milestone 4:	Site Management Plan	December 2020
• Milestone 5	Periodic Review Report	Annually
• Milestone 6:	Monitoring and Reporting	Quarterly

4.2 Key Project Personnel

A list of the project personnel of the prime consultant responsible for performance of the O&M and monitoring has been submitted to the NYSDEC for approval. Primary project staffs are listed below. The resumes are included as **Appendix A**:

Personnel	Company	Title for this Work Assignment	Responsibility
David Feinson (Project Manager)	HRP Associates, Inc. (Prime Consultant)	Project Manager	Overall management of the WA
Mark Wright PG, CSP (Project Manager)	HRP Associates, Inc.	Office Health & Safety Manager	Review and approval of HASP and responsible for overall health and safety issues with the WA
Michael Varni (Senior Project Geologist)	HRP Associates, Inc.	Corporate QA/QC Officer	Responsible for QA/QC on the WA
A. Sasha Isenberg (Senior Project Scientist)	HRP Associates, Inc.	Field Manager and Site Health & Safety Officer	Responsible for the on-site sampling and investigative tasks oversight
David Adam (Senior Field Technician)	HRP Associates, Inc.	Alternate Field Manager and Site Health & Safety Officer	Responsible for the on-site sampling and investigative tasks

FIGURES

0 1,000 2,000 4,000 6,000 8,000

Feet

1 inch = 2,000 feet

N

USGS Quadrangle Information
Quad ID: 40073-F3
Name: Bay Shore West, New York
Date Rev: 1978
Date Pub: 1979

Figure 1
Site Location
63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125
HRP # DEC1004.OM
Scale 1" = 2,000'

HRP
MOVE YOUR ENVIRONMENT FORWARD
ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM

Path: S:\Data\NYDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\GIS\Figure 1 - 63 West Montauk.mxd

HRP
MOVE YOUR ENVIRONMENT FORWARD
ONE FAIRCHILD SQUARE
SUITE 110
CLIFTON PARK, NY 12065
(518) 877-7101
HRPASSOCIATES.COM

Site Layout Map

63 West Montauk Highway
Lindenhurst, New York
NYSDEC Site No. 152125

ASI	11X17
DESIGNED BY:	SHEET SIZE:
BOB	08/04/2020
DRAWN BY:	DATE:
DJF	DEC1004.OM
REVIEWED BY:	PROJECT NUMBER:

North

1 in = 150 ft

0 75 150 Ft

FIGURE 2

Path: S:\Data\NYSDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION\BABYLON\63 WEST MERRICK ROAD\DEC1004OM\GIS\Figure 3 - 63 West Montauk.mxd

TABLES

Table 1
Sample Summary
Active Industrial Uniform Superfund Site
63 West Merrick Road, Lindenhurst, NY
NYSDEC Site Number: 152125

Activity/ Matrix	Sampling frequency	Number of Sample	Samples to be Collected	Analyses
Monitoring Wells/ Groundwater	Quarterly	10	14 (includes 2 trip blanks and two duplicate samples, assuming 2 days for sampling)	VOCs by EPA Method 8260
	Semi-Annually	5	5 (in addition to the quarterly samples)	

Acronym List:
VOCs: Volatile Organic Compounds

Quarterly Sampling: MW-2S, MW-4D, MW-5S, MW-103, MW-104, MW-105, MW-106, MW-107, RW-1, RW-2

Semi-Annual Sampling: MW-101, MW-102, MW-108, MW-109, MW-111

Table 2
Analytical Methods/Quality Assurance Summary
Active Industrial Uniform Superfund Site
63 West Merrick Road, Lindenhurst, NY
NYSDEC Site Number: 152125

Parameter	Matrix	Number of Samples (including Field QC)	Preparation Method	Analytical Method*	Containers per Sample: No.	Containers per Sample: Size	Containers per Sample: Type	Preservation Requirements: Temp.	Preservation Requirements: Light Sensitive	Preservation Requirements: Chemical	Maximum Holding Time
GROUNDWATER											
VOCs by GC/MS	Aqueous	**14 quarterly**: MW-2S, MW-4D, MW-5S, MW-103, MW-104, MW-105, MW-106, MW-107, RW-1, RW-2, Trip Blank (2), Duplicates (2) **19 semi-annually**: MW-2S, MW-4D, MW-5S, MW-101, MW-102, MW-103, MW-104, MW-105, MW-106, MW-107, MW-108, MW-109, MW-111, RW-1, RW-2, Trip Blank (2), Duplicates (2)	5035	SW-846 Method 8260B	2	40 ml	glass vial	2-6º C	No	HCL	14 days

Acronym List:
GC: Gas Chromatography
ICP: Inductively Coupled Plasma
HCL: Hydrochloric Acid
MeOH: Methanol
CV: Cold Vapor
VOCs: Volatile Organic Compounds
SVOCs: Semi-Volatile Organic Compounds
TAL: Target Analyte List
PCBs: Polychlorinated Biphenyls

APPENDIX A
Resumes of Key Project Personnel

SENIOR PROJECT GEOLOGIST

DAVID J. ADAM

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Remedial Design (RD)
- Site Response Activities/Interim Remedial Measures (IRM)
- Site Management (SM)
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

David J. Adam serves as a Senior Project Geologist for HRP. Mr. Adam has 34 years of experience in the environmental consulting industry. Mr. Adam has been responsible for the management of RCRA investigations, underground tank studies, monitor well design and installations, Phase I environmental assessments, Phase II subsurface investigations, delineation of groundwater contamination, remedial action design, system construction/installation/supervision, remedial systems operation and maintenance and brownfields redevelopment.

Mr. Adam's primary responsibilities include design and installation of remedial systems and the operation and maintenance of such systems. Mr. Adam troubleshoots Programmable Logic Controllers (PLC), relays, pressure transducers, flow sensors/meters, motor starters and motors; liquid handling pumps including, submersible, centrifugal, peristaltic, bladder, diaphragm and magnetic drive; liquid ring multiphase pumps; air handling equipment, including regenerative and axial blowers; air compressor's including rotary vane and 2 stage piston. Additionally, Mr. Adam also maintains equipment associated with the pumps including air strippers, oil/water separators, pump stations and numerous open and closed tanks and level control and monitoring systems.

Former Bearing Manufacturing Facility, Newington,CT

This project involved the design and construction of a groundwater treatment system to treat groundwater and discharge it to a local stream, from an existing recovery system. The existing system had discharged untreated groundwater to a municipal sanitary treatment facility. The new treatment system consists of several equalization tanks, bag filters, an air stripper and two carbon vessels along with associated level controls and pumps. In addition to being involved with the design and construction of the system, Mr. Adam presently operates and maintains the treatment system. This phase of the treatment system was constructed in 2016.

State of Connecticut Department of Transportation Railroad station, Greenwich, CT

This project involved the supervision of remedial activities with regard to the installation of a new storm water collection system and parking lot reconstruction. Supervision included sample collection, supervision of soil disposal and coordination with project managers and state officials. The project started in 2015 and is ongoing.

State of Connecticut Department of Transportation Railroad station, Stamford, CT

This project involved the supervision of remedial activites related to the construction of elevators to passenger railroad platforms. The project started in 2015.

NSPE LEVEL

III

EDUCATION

- BS, Environmental Earth Science, Eastern Connecticut State University, 1984

PROFESSIONAL REGISTRATIONS/ CERTIFICATIONS

- Connecticut Non-Water Supply Licensed Contractor/ Driller

PROFESSIONAL ORGANIZATIONS

- National Ground Water Association
- Soil & Water Conservation Society

TRAININGS

- OSHA 40HR Health and Safety Training
- OSHA 10HR Construction Safety Training
- OSHA 6HR Confined Space Training
- OSHA NFPA 70E, Recommended Electrical Safety Related Work Practices
- Connecticut UST Class A/B Operator Training
- Basic Electricity for the Non Electrician - 2 Day
- Electrical Troubleshooting and Preventative Maintenance-2 Day
- Veeder Root ATG Technician Certification-AGT Monitoring Systems installation, programming and service

Former Textile Manufacturing Plant, Plainfield, CT
Mr. Adam conducted environmental investigations, which included test boring, test pit, and monitor well installation. Mr. Adam also evaluated the resulting data and prepared reports with recommendations for further investigations and remediation. As a result of the investigations, remediation, including soil removal and the installation of several soil vapor extraction systems, took place. Mr. Adam prepared health and safety plans and supervised the removal and disposal of soils as well as construction of the SVE systems.

Former Electronics Controls Manufacturer, Orange, CT
HRP completed a remedial investigation and design and construction management at this site. Mr. Adam supervised the installation of test borings. Also, Mr. Adam provided oversight during remedial activities, which included soil remediation. He also supervised and installed a soil vapor recovery system and soil vapor points. Presently, Mr. Adam operates and maintains the soil venting system and existing groundwater treatment system.

Brownfields Redevelopment, Colt Gateway LLC, Hartford, CT
This project consisted of the redevelopment of a mixed-use property encompassing approximately 17 acres. During this project, Mr. Adam supervised the installation of test pits, sampled sediments from sanitary sewer lines, and supervised remedial activities, which included soil removal and underground tank removal. Mr. Adam also provided oversight during construction of new infrastructure.

Remedial Action Design and Supervision
Mr. Adam has designed and supervised soil and groundwater remediation projects. Such supervision has included:
- Preparation of cost estimates and determination of remedial equipment required to complete project
- On-site supervision of remedial project
- Supervision design construction and/or installation of remedial treatment systems including soil vapor extraction systems, air sparging systems, and shallow ground water recovery wells.

Underground Tank Studies
Mr. Adam has performed numerous underground tank assessments at commercial, retail, industrial, and residential sites. Many of the investigations have resulted in remediation of contaminated soil and groundwater due to the detection of leaking underground storage tanks. Tasks required have included:
- Design and supervision of tank and associated contaminated soil removal
- Design, supervision construction, and installation of light-phase organic liquid recovery wells and recovery equipment

Monitor Well Design and Installation
Mr. Adam has designed and installed monitor wells as part of hydrogeologic investigations at more than one hundred sites. Design of monitor wells has required:
- Definition of subsurface materials through logging of soil borings and rock cores
- Estimation of hydraulic conductivities through review of sieve analyses data and aquifer tests (slug tests)
- Selection of construction materials based upon review of chemical parameters to be monitored, geochemistry, and other site-specific features

State of Connecticut Department of Transportation Railroad station, Bridgeport, CT
This project involved the supervision of remedial activities, related to the building of new railroad passenger platforms. Work included supervision of soil reuse and disposal and coordination with project managers and state officials. The project stared in 2015.

Connecticut Department of Transportation Rocky Hill, CT Landfill
Mr. Adam provided environmental oversight of landfill disruption operations. This work included field data collection, supervision of remedial contractor activities and coordination with project managers and state officials.

Fort Trumbull, Brownfields Redevelopment, New London, CT
Mr. Adam has been involved in a large Brownfields project encompassed over one hundred individual properties comprised of commercial, residential, industrial, and military use. Mr. Adam's involvement has included supervision of remedial activities, coordination with state and local officials, collection of field data, and preparation of remedial action reports.

PROJECT MANAGER

DAVID J. FEINSON, PG

ROLE AND RESPONSIBILITY

As a Project Manager for this contract, Mr. Feinson will be responsible for the administration of work required by the Work Assignment. The management of each work assignment may include development of work scope and cost assessments, procurement of supporting subcontractors and/or consultants, coordination of work scope items from resource management to scheduling and implementation. Mr. Feinson will work with the Quality Assurance Officer to develop site-specific quality assurance plans, as pertinent to the Work Assignment and will act as the primary point of contact for each assigned project.

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Remedial Design (RD)
- Site Response Activities/Interim Remedial Measures (IRM)
- Site Management (SM)
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

David J. Feinson is a Project Manager with over 10 years of experience in environmental assessment, site investigation, and remediation. He has performed site assessment, investigation, and remediation services for a number of governmental, municipal, private, and industrial clients.

Mr. Feinson has performed multiple Phase I Environmental Site Assessments (ESAs) following the relevant ASTM standards and Connecticut's Site Characterization Guidance Document (SCGD) to identify recognized environmental conditions (RECs), potential release areas (PRAs), and areas of concern (AOCs). Following the Phase I ESA, David has coordinated and performed Phase II and Phase III ESAs in order to determine the presence or absence of contamination due to releases of hazardous materials and the degree and extent of impact to soils and groundwater at each site. David has worked with clients to select and implement the appropriate remedial technologies at each site in order to demonstrate compliance with the applicable state remediation standards.

His technical duties include performance and coordination of site assessments, logging and sampling soil borings, underground storage tank removal and closure sampling, monitoring well installations and sampling, data evaluation and interpretation. Mr. Feinson prepares various technical reports for review by the state and/or Environmental Protection Agency (EPA) documenting the environmental condition of sites and evaluating remedial alternatives. Remedial technologies are selected based on the reports to determine the best strategy for each individual situation.

School Building, Hartford, CT
Served as Project Geologist for a geotechnical evaluation for the construction of a 4,000 square-foot building addition to an existing structure. Responsibilities included

NSPE

VI

EDUCATION

- BA, Geology SUNY Plattsburgh, 2003

PROFESSIONAL REGISTRATIONS/ CERTIFICATIONS

- Professional Geologist: Idaho, PGL-1413
- CT-Certified Class A/B UST Operator
- Massachusetts Certified Class A/B Underground Storage Tank Operator #141820

TRAININGS

- OSHA 40HR Hazardous Waste Operations & Emergency Response, 2011
- OSHA 10-Hour Construction Safety, 2012
- OSHA 8-hour HAZWOPER refresher training, 2012-2019

logging and sampling soil borings and analysis of laboratory data in order to provide the structural engineer with expected foundation settlements and modulus of subgrade reaction. Services were completed in 2012.

Government Facility, Bronx, NY
Served as Project Geologist for a geotechnical investigation of subsidence observed in parking areas around an existing facility. Responsibilities included a background review of the site and surrounding area to evaluate historical structural development, interpretation of Ground Penetrating Radar (GPR) survey data, and logging and sampling of geotechnical borings. GPR survey, field, and laboratory data were analyzed to provide the client with a report presenting the findings of the investigation. The cause of subsurface settlement was identified and recommendations for mitigation of the settlement issues were presented in the report as well. Services were completed in 2013.

Seawall, Bronx, NY
Served as Project Geologist for a geotechnical investigation of an existing seawall that required replacement due to deteriorating conditions along a roadway. Responsibilities included logging and sampling exploratory borings to evaluate subsurface conditions in the project area, analysis of laboratory data, and providing assistance to the structural engineer for design of the new wall. Services were completed in 2013.

LNAPL Recovery, Newington, CT
Serves as Senior Project Geologist for the recovery of light non-aqueous phase liquid (LNAPL) from the water table at a former manufacturing facility. Responsibilities include general overview of operation and maintenance of a groundwater depression and product recovery system, analysis of laboratory data, preparation of semi-annual reports for submission to CT DEEP, and preparation of documents required under a general permit for discharge of remediation wastewater. Services for this project are ongoing.

Manufacturing Facility, Waterbury, CT
Serves as Senior Project Geologist for the recovery of product from the water table at a manufacturing facility. Responsibilities include general overview of operation and maintenance of a remediation system (including soil vapor extraction (SVE), multi-phase extraction (MPE), and groundwater recovery), analysis of laboratory data, preparation of semi-annual reports for submission to CT DEEP, and preparation of documents required under a general permit for discharge of remediation wastewater. Services for this project are ongoing.

Former Manufacturing Facility, Seabrook, NH
Serves as Senior Project Geologist for the investigation and remediation of a large industrial facility prior to a transfer of ownership of the property. Responsibilities include review of historical documents related to previous environmental investigations and remediation, performance of subsurface investigation work to close out data gaps, data analysis, and an evaluation of remedial alternatives. Services for this project are ongoing.

Brownfields Site, Torrington, CT
Served as Project Geologist for the remediation and redevelopment of a former manufacturing facility. Responsibilities included the completion of an Analysis of Brownfields Cleanup Alternatives (ABCA) for review by EPA in order to secure funding from the Brownfields Revolving Loan Fund (BRLF), support for the preparation of an EPA-approved Quality Assurance Project Plan (QAPP), evaluation of subsurface soils related to pavement design, remediation oversight, and analysis of soil analytical data. Services for this project were completed in 2014.

Former Carburetor Manufacturing Facility, St. Louis, MO
Served as Senior Project Geologist for the investigation and remediation of a former manufacturing facility. Responsibilities included review of field data and laboratory analytical data to develop a plan for remediation of soil and groundwater impacted with chlorinated solvents. Contaminated soils and groundwater were remediated using in-situ thermal desorption (ISTD) and soil vapor extraction (SVE). Services for this project are ongoing.

PROJECT SCIENTIST

A. SASHA ISENBERG

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Remedial Design (RD)
- Site Response Activities/Interim Remedial Measures (IRM)
- Site Management (SM)
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

A. Sasha Isenberg has over nine years of experience in the environmental consulting industry. Her project experience includes environmental site assessments, subsurface investigations, site remediation, and environmental compliance. She has performed these services for a number of client sectors, including attorneys, municipal government, lending institutions, real estate development, manufacturing, and utilities.

Ms. Isenberg's is particularly experienced in Phase I Environmental Site Assessments (ESA), Phase II and III Subsurface Investigations, groundwater monitoring, stormwater sampling, and soil remediation oversight. Regulatory experience includes a working knowledge of the Connecticut Remediation Standard Regulations (RSRs) with experience in the preparation of various Remedial Action Plans (RAP), Remedial Action Reports (RAR), Quality Assurance Project Plans (QAPP), Environmental Condition Assessment Forms (ECAF), Significant Environmental Hazard (SEH) reporting, and preparation of Completion of Investigation (COI) reports. The environmental compliance experience includes preparation of Spill Prevention Control and Countermeasure (SPCC) Plans and Stormwater Pollution and Prevention Plans (SWPPP).

Ms. Isenberg served as the lead project scientist for the investigation and remediation of soils contaminated with petroleum products and chlorinated solvents. Ms. Isenberg's responsibilities included in-depth background research, identification of Areas of Concern, design and implementation of subsurface investigations, lateral and vertical delineation of contaminant impact to the soil and groundwater; design and implementation of localized soil remediation activities via excavation; project coordination, communications and reporting.

NSPE LEVEL

III

EDUCATION

- B.S. Environmental Science with Concentration in Environmental Health

PROFESSIONAL REGISTRATIONS/ CERTIFICATIONS

- Metro-North Railroad Safety Certificate Number 003325, Connecticut Department of Transportation

PROFESSIONAL ORGANIZATIONS

- Environmental Professionals' Organization of Connecticut, Member
- Young Environmental Professionals of Connecticut, Member

TRAINING

- PFAS Analysis, Fate and Transport to Develop Robust Conceptual Site Models, 2020
- PFAS and Due Diligence: Practical Information for Managing the Emerging Risk, 2019
- OSHA 8-hour Refresher Course in Hazardous Waste Operations and Emergency Response, 2019
- Adult CPR / First Aid Certified, 2018
- RCRA Hazardous Waste Management, 2017
- OSHA 40-hour Hazardous Waste Operations and Emergency Response, 2017
- OSHA 10-hour Construction Safety, 2017

BASE OFFICE LOCATION

Farmington, CT

PROJECT MANAGER

MARK E. WRIGHT, PG, CSP, CHMM

ROLE AND RESPONSIBILITY

As a Project Manager for this contract, Mr. Wright will be responsible for the administration of work required by the Work Assignment. The management of each work assignment may include development of work scope and cost assessments, procurement of supporting subcontractors and/or consultants, coordination of work scope items from resource management to scheduling and implementation. Mr. Wright will work with the Quality Assurance Officer to develop site-specific quality assurance plans, as pertinent to the Work Assignment and will act as the primary point of contact for each assigned project.

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Site Response Activities/Interim Remedial Measures (IRM)
- Site Management (SM)
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

Mr. Wright has over 13 years of experience in conducting environmental investigations. Mr. Wright is experienced in all phases of environmental investigation projects, including Completing the initial Site Characterization Investigation, Completing Remedial Investigations and Feasibility studies, Soil Vapor Intrusion Studies, the selection and implementation of Interim Remedial Measures, the development and implementation of Quality Assurance Project Plans, the development and implementation of site specific Health and Safety Plans, participation in Citizen participation activities, implementation of Site Management Plans, and Third Party Oversight.

Mr. Wright has completed a diverse array of site investigations including investigations into groundwater contamination in various media including, overburden, fractured bedrock, and competent bed rock as well as the interaction between different aquifers. Mr. Wright has used investigation data to develop conceptual site models, including groundwater flow and contaminant transport, the completion of Aquifer testing to establish aquifer characteristics, the implementation of geophysical techniques and the uploading of data to EQuIS. In addition to completing investigatory step during projects Mr. Wright develops and tracks project budgets and other project management elements. Mr. Wright has provided these services on a number of projects for governmental, municipal, commercial and industrial clients.

Mr. Wright's areas of expertise include Site Characterizations and Remedial Investigations. Mr. Wright specializes in the investigation of contaminated groundwater plumes, including source area investigations, plume degree and extent and the identification of potential receptors of contaminated groundwater.

NSPE LEVEL

VI

EDUCATION

- BS, Water Resources, State University of New York Collage at Oneonta, 2003

PROFESSIONAL REGISTRATIONS/ CERTIFICATIONS

- PG, #693, NY
- Certified Safety Professional (#31227)
- Certified Hazardous Materials Manager (#173260)

PROFESSIONAL ORGANIZATIONS

- Environmental Professionals Organization of Connecticut
- National Ground Water Association

TRAINING

- OSHA 40 Hour Health and Safety for Hazardous Waste Site
- OSHA 8 Hour Supervisor of Hazardous Waste Operation

BASE OFFICE LOCATION

Clifton Park, NY

EXPERIENCE

MANAGEMENT OF INACTIVE HAZARDOUS WASTE, HAZARDOUS SUBSTANCE AND PETROLEUM SPILL SITES

Site Management of Petroleum Spill and Hazardous Waste Site, NYSDEC Contract D006130, North Lawrence Oil Dump Site, North Lawrence, NY

Served as a Senior Project Geologist for the NYSDEC North Lawrence Oil Dump Site. Responsibilities included implementation of the Site Management Plan, including monitored natural attenuation groundwater sampling, landfill gas monitoring and site inspections; the development of sampling reduction plans to eliminate several wells from the sampling program, oversight groundwater monitoring well decommissioning for a portion of the groundwater monitoring network. Analysis of groundwater sampling results and preparation of Periodic Review Reports. Services were completed in 2015.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSOGS Contract SA 953, Fishkill Correctional Facility, Beacon, NY

Mr. Wright served as a Project Manager for this NYSOGS project to conduct an environmental sampling program during the development of the bid documents for the replacement of three 100,000 gallon AST at the boiler house of the correctional facility. Responsibilities included working with NYSOGS Project Managers on the development of a Site Characterization Plan, coordination with DOCs personnel to clear security requirements, oversight of the use of ground penetrating radar prior to initiating a soil boring program, field oversight of the installation of soil borings to identify areas of environmental impact from the historic use of the area as a tank farm, and the use of lead based paint on the system pipiing, identifying areas of lead paint using XRF equipment and collecting samples of building materials for the presence of PCBs. Information collected during the site characterization was used define the volumes of soil to be removed during the replacement of three 100,000 gallon AST at the boiler house of the correctional facility.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSOGS, Contract SA 953, Otisville Correctional Facility, Building 165, Otisville, NY

Mr. Wright served as a Project Manager for this NYSOGS project to conduct a Site Characterization, in accordance with DER-10, during removal of a 1,000 gallon UST at building 165 of the correctional facility. Responsibilities included budget and scope development, field oversight of UST contractors conducting the removal, screening environmental media uncovered during the removal to identify a release of product to the environment, spill reporting, coordination with OGS field Engineer to approve and execute an immediate environmental remedial excavation, collection of environmental samples in coordination with OGS field Engineers and NYSDEC Spill Engineers, with NYSDEC requirements, completion of UST closure report, including request to close the spill, follow-up with NYSDEC to ensure spill was closed meeting standards.

Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSOGS, Contract SA 953, DOT Region 9 Maintenance Sub-Headquarters, Schenevus, NY

Mr. Wright served as a Project Manager for this NYSOGS project to conduct a Site Characterization, in accordance with DER-10 during removal of a 1,000 and a 4,000 gallon UST at the DOT facility. Responsibilities, budget and scope development, field oversight of UST contractors conducting the removal, screening environmental media uncovered during the removal to identify a release of product to the environment, spill reporting, coordination with OGS field Engineer to approve and execute an immediate environmental remedial excavation, coordination with UST contractors to segregate and stockpile impacted soils, Coordination with OGS project Engineer and DEC spill manager to secure approval for onsite treatment and reuse of contaminated soil, collection of environmental samples in accordance with NYSDEC requirements, completion of UST closure report, including request to close the spill, follow-up with NYSDEC to ensure spill was closed meeting standards.

Aquifer Testing in support of Groundwater Withdrawal Permit, Kraft Foods, Campbell, NY

Served as Project Manager for the completion of an aquifer testing program in support of a Groundwater Withdrawal Permit approval from the Susquehanna River Basin Commission, Responsibilities included development of Aquifer Test Plan, obtaining general permit from the ACOE for weir construction, planning and oversight of installation of monitoring well network, public notifications for testing, coordination with neighboring property owners to conduct monitoring on their property, data collection, data analysis, including the calculating of aquifer flow parameters and long term stability of the proposed water withdrawal as well as permit form completion and submittal.

Emerging Contaminants Sampling, Balchem Corporation, Slate Hill, NY

Served as a Project Manager for the development and implementation of a emerging contaminates sampling program at a Class 04 State Superfund Program Site. Responsibilities included reviewing historic data to create a sampling plan for PFAS and 1,4-dioxane in the two groundwater aquifers on-site, submittal of the plan to the NYSDEC project manager for approval,

EXPERIENCE

development of a field sampling plan and training program to ensure that cross contamination was avoided during sampling, oversight of the sampling program and data analysis and reporting. Services were completed in 2018.

<u>Site Management, Phased Remedial Investigation/Feasibility Study of Petroleum Spill and Hazardous Waste Site, Brownfields Site, Ulster County, NY</u>
Served as a Project Manager for the completion of a Remedial Investigation/Feasibility Study and site management of a brownfield clean-up program of an inactive waste disposal site in Ulster County, NY. Project responsibilities included working under the supervision of the NYSDEC Project Manager to review historical data and using that data to aide in the development of a Remedial Investigation strategy, development of a field activities plan, development of a site specific health and safety plan, and coordination with the NYSDOH, NYSDEC and site owners to identify and investigate all potential receptors of subsurface contamination in the area that could impact human health and the environment. Specialized tasks performed during the investigation include: Interpretation of Ground Penetrating Radar (GPR) Electromagnetic Survey(EM) data to identify the location of subsurface anomalies indicative of disposal areas, Completion of soil vapor intrusion evaluation, including the evaluation of sampling network based on interpretation of geologic data, the use of passive gas sample network, and evaluation of passive soil gas data to identify potential groundwater contamination source areas, oversight of test pit installation in order to horizontally delineate subsurface contamination. oversight of soil boring installation to delineate contamination horizontally and vertically, the installation and sampling of a monitoring well network, the development of remedial alternatives, and the development and implementation of ad Site management Plan for the selected remedial strategy of monitored natural attenuation.

<u>Site Characterization of Petroleum Spill and Hazardous Waste Site, NYSDEC Contract D006130 Site Characterization McCall Place, Newburgh, NY</u>
Served as a Senior Project Geologist for the Site Characterization completed at the NYSDEC McCall Place Site. The Site Characterization was completed to identify the source of chlorinated solvents detected in private drinking water wells located along McCall Place. Proect responsibilities included working with NYSDEC Project Manager to review historical data and using that data to aide in the development of a Site Characterization strategy, development of a field activities plan, development of a site specific health and safety plan, and coordination with the NYSDOH, NYSDEC and area residents to identify and investigate all potential receptors of subsurface contamination in the area that could impact human health and the environment. Specialized tasks performed during the investigation include: The use of passive soil gas sampling and ground penetrating radar to identify potential hazardous waste disposal areas; the planning and oversight of the installation of an area wide groundwater monitoring well network, interpretation of groundwater flow and contaminant concentration data development and maintenance of conceptual site model, and the upload of project data to the NYSDEC EQuIS sever. The results of the site characterization identify three distinct plumes of chlorinated solvents in the area of the site, however a specific source area could not be identified.

<u>Phased Remedial Investigation/Feasibility Study, Site Response Activities/Interim Remedial Measures of Petroleum Spill and Hazardous Waste Site, NYSDEC Contract D006130, Barthelmes Manufacturing Site, Rochester, NY</u>
Served as a Senior Project Geologist for the Remedial Investigation/Feasibility Study, including Interim Remedial Measures, completed at the NYSDEC Barthelmes Manufacturing Site. The Remedial Investigation/Feasibility Study was completed to define the degree and extent of subsurface contamination related to the historic use of the site as a manufacturing facility. Project responsibilities included working with NYSDEC Project Manager to review historical data and using that data to aide in the development of a Remedial Investigation strategy, development of a field activities plan, development of a site specific health and safety plan, and coordination with the NYSDOH, NYSDEC and site owners to identify and investigate all potential receptors of subsurface contamination in the area that could impact human health and the environment. Specialized tasks performed during the investigation include: the completion of an Interim Remedial Measure to remove source material contributing to a chlorinated solvent groundwater plume. The IRM consisted of the removal of soil from under the slab on grade foundation of the building. Other task included the evaluation of an existing groundwater monitoring well network, planning and oversight of the installation additional groundwater monitoring wells to supplement the existing monitoring well network, interpretation of groundwater flow and contaminant concentration data, development and maintenance of conceptual site model to identify the source and potential receptors of subsurface contamination including evaluating hydrogeologic conditions for use in the evaluation of potential remedial actions, and the upload of project data to the NYSDEC EQuIS sever.

SENIOR PROJECT GEOLOGIST (STAFF)

MICHAEL A. VARNI, LEP

IDENTIFIED WORK ELEMENTS EXPERIENCE

- Site Characterization
- Phased Remedial Investigation/Feasibility Study (RI/FS)
- Soil Vapor Intrusion (SVI) Investigations
- Analytical Quality Assurance/Quality Control Activities (QA/QC)
- Citizen Participation (CP) Activities
- Health and Safety Plan (HASP) Development
- Potentially Responsible Parties (PRP) and Third-Party Oversight

SUMMARY OF QUALIFICATIONS

Mr. Varni has over 10 years of experience in environmental assessment and site investigation. He has performed these services for a number of governmental, municipal, commercial, industrial and private clients. Specifically, Mr. Varni has been responsible for Phase I Environmental Site Assessments at small- to large-scale commercial and industrial facilities. In all cases, the specific manufacturing processes were analyzed and waste streams were defined to identify all potential sources and releases of contaminants to the environment. Mr. Varni has performed numerous Phase II and Phase III investigations involving drilling and test pit supervision, monitoring well installation, and sampling of soils, groundwater, and soil vapor. Mr. Varni has performed numerous site remediation oversight projects including soil excavation, groundwater treatment systems, and vapor extraction systems.

Remedial Actions, West Hartford, CT

This project involved the cleanup and redevelopment of a former large engine break and drill chuck manufacturer contaminated with PCBs, petroleum, and chlorinated solvents. The project involved demolition of the existing industrial building, followed by removal of subslab piping and drainage structures, and finally remediation of soils to achieve compliance with both state and federal regulations. Mr. Varni's responsibilities included supervision of remediation contractors conducting soil excavation, field monitoring and sampling of soil and groundwater, field monitoring of dust and weather conditions according to a project specific remediation and health and safety plan, coordination with construction and remediation crews, and data management and analysis. The project culminated in a successful Brownfields-type redevelopment of the property into a retail shopping center.

Phase I Environmental Site Assessments

- Inspection of a wide variety of commercial and industrial facilities and properties to identify specific site environmental conditions and concerns
- Interviewing site contacts and municipal, state, and federal officials to determine current and former site use and environmental concerns
- Historical research into current and former land use and regulatory history through review of aerial photographs and other published sources and state and local agency records
- Review of published geologic data to determine site setting including surficial and bedrock geology, and groundwater and surface water, and other environmental factors to evaluation contaminant migration potential.

Phase II and III Subsurface Investigations

- Identification of potential contamination sources at sites due to present and historical land uses
- Collection, description, and interpretation of split spoon sediment samples

NSPE LEVEL

VII

EDUCATION

- MS, Geology, University of Maryland, College Park, Maryland, 2002
- BS, Environmental Earth Science, Eastern Connecticut State University, Willimantic, Connecticut, 1999

TRAINING

- OSHA 40 Hour Hazardous Waste Operations & Emergency Response
- OSHA 8 Hour Refresher Hazardous Waste Operations & Emergency Response

PUBLICATIONS

- The effect of rising atmospheric oxygen on carbon and sulfur isotope anomalies in Neoproterozoic Johnnie Formation, Death Valley, USA. Kaufman, A. J., Corsetti, F.A., and Varni, M.A.

BASE OFFICE LOCATION

Farmington, CT

APPENDIX I

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REMEDIAL SYSTEM OPTIMIZATION FOR Active Industrial Uniform

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APPENDIX J
Permits and/or Permit Equivalent