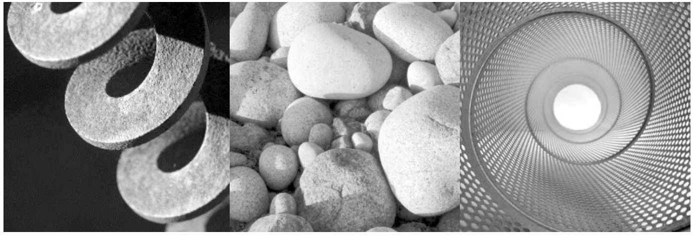

GEI Consultants

Consulting
Engineers and
Scientists

Interim Site Management Plan

Skillman Street Holder Station

Brooklyn, New York
AOC Index No.:A2-0552-0606
Site No. 224068

Prepared for:
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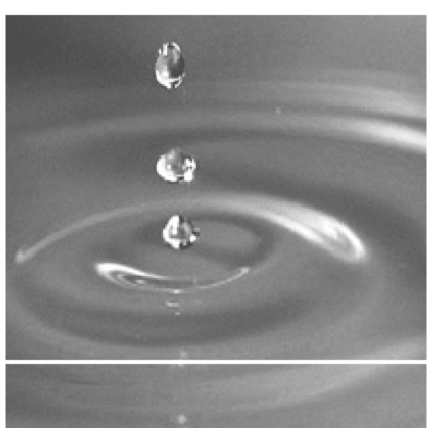

Melissa J. Felter, Project Manager

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MARCH 2017

CERTIFICATION STATEMENT

I, Matthew J. O'Neil certify that I am currently a New York State registered professional engineer and that this Interim Site Management Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

March 10, 2017

Date

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It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
AWQS	Ambient Water Quality Standard
bgs	Below Ground Surface
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulation
COC	Certificate of Completion
CP	Commissioner Policy
CPP	Citizen Participation Plan
DER	Division of Environmental Remediation
DRO	Diesel Range Organics
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
EPA	U.S. Environmental Protection Agency
ES	Executive Summary
EWP	Excavation Work Plan
GEI	GEI Consultants, Inc., P.C.
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
IC	Institutional Control
ISMP	Interim Site Management Plan
MGP	Manufactured Gas Plant
MTA	Metropolitan Transit Authority
NAVD	North American Vertical Datum
NYCDOHMH	New York City Department of Health and Mental Hygiene
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OCAS	Order on Consent and Administrative Settlement
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene (perchloroethylene)
PDI	Pre-Design Investigation
PRR	Periodic Review Report

QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
ROW	Right of Way
RP	Remedial Party
SC	Site Characterization
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SVI	Soil Vapor Intrusion
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCE	Trichloroethylene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
TOGS	Technical and Operational Guidance Series
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transportation
VOC	Volatile Organic Compound

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 Interim Site Management Plan (ISMP):

Site Identification:	No. 224068, Skillman Street Holder Station, 7 Skillman Street and a 10' by 90' strip (the Bedford Strip) of 744 Bedford Avenue, Brooklyn, New York (collectively, the Site). The Bedford Strip was historically part of the property located at 7 Skillman Street and is currently part of the property located at 744 Bedford Avenue.

Institutional Controls:	1. The Site may be used for restricted residential; commercial, or industrial use;
	2. Environmental Easements shall be placed on the Site to prevent future exposure to impacts
	3. Implement, maintain and monitor Engineering Control (EC) systems at the Site. All ECs must be inspected at a frequency and in a manner defined in the ISMP
Engineering Controls:	1. Cover system
Inspections:	Frequency:
1. Cover inspection	Annually and after severe weather conditions that may affect ECs
Monitoring:	
1. Monitoring Wells	Annually
2. Soil Vapor Intrusion	As Needed for New Construction
Reporting:	
1. Groundwater Sampling Data	Annually
2. Periodic Review Report	Annually
3. Severe Conditions Inspection Report	As Needed
4. Soil Vapor Intrusion	As Needed for New Construction

The property owner is required to comply with this ISMP including all notifications to National Grid and provisions of the Excavation Work Plan (Appendix B). National Grid is only responsible for costs associated with Manufactured Gas Plant-related impacts. Further descriptions of the above requirements are provided in detail in the latter sections of this Interim Site Management Plan.

In addition, the New York State Department of Environmental Conservation (NYSDEC) sent a letter to the legal counsel for the owners of the 7 Skillman Street and 744 Bedford Avenue properties. The intent of the letter was to "ensure that the owners of the properties are aware of the results of an investigation undertaken by National Grid in March 2016 and the implications of any redevelopment work to be undertaken." NYSDEC also sent an email to Region 2 describing chlorinated volatile organic compound (VOC) detections in soil vapor and that National Grid is not responsible for these impacts. This email and letter are provided in Appendix D and discussed further in Section 1.5. The Excavation Work Plan is included in Appendix B.

1. Introduction

1.1 General

This Interim Site Management Plan (ISMP) is a required element of the remedial program for the Skillman Street Holder Station Site located at 7 Skillman Street and a 10-foot by 90-foot strip (the Bedford Strip) of 744 Bedford Avenue (hereinafter collectively referred to as the “Site”) located in Brooklyn, New York. See Figure 1 for the general location. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program as Site No. 224068 which is administered by New York State Department of Environmental Conservation (NYSDEC). 744 Bedford Avenue, with the exception of the Bedford Strip, was listed in the Brownfields Cleanup Program in July 2014 with Site Code: C224193.

The Brooklyn Union Gas Company, now d/b/a National Grid NY (National Grid), entered into an Order on Consent and Administrative Settlement (OCAS) Index # A2-0552-0606, on February 7, 2007 (last amended September 2009) with the NYSDEC to investigate and remediate, if required, Manufactured Gas Plant (MGP)-related impacts at the Site. The vicinity of the Site and property boundaries, are provided in Figure 2. The boundaries of the Site are more fully described in the metes and bounds Site description that is part of the Environmental Easement provided in Appendix A. The Environmental Easement is granted by the owner of the Site (the “Grantor”) to the NYSDEC, and shall be recorded at the County Clerk by the Remedial Party and Respondent (RP).

Upon completion of the investigation work, some target compounds and target analytes were determined to have been detected in samples collected at the Site. Exposure pathways to subsurface soil, groundwater, and soil vapor are minimized while the property remains in its current use and the soils are undisturbed. Institutional and Engineering Controls (ICs and ECs) have been incorporated into the ISMP to control exposure to target compounds and target analytes detected at concentrations exceeding applicable Standards, Criteria and Guidance (SCGs) in environmental samples collected at the Site (*i.e.* impacts), to ensure protection of public health and the environment. An Environmental Easement, granted to the NYSDEC by the property owners (see Table 1, hereinafter “the Property Owners” and/or “the Grantors”), and recorded with the Kings County Clerk, requires compliance with this I SMP and all ECs and ICs placed on the Site.

An EC and IC will be implemented under this ISMP to control exposure to impacts and to ensure protection of public health and the environment. The EC on the Site is a cover system. The IC consists of an Environmental Easement, to be granted to the NYSDEC by the Site property owners and recorded with the Kings County Clerk, which requires compliance with the ISMP and all established ECs and ICs for the Site. Since the final remedy has not yet been completed for the Site, this ISMP will be implemented to address intrusive activities prior to the final remedy or any portion of the final remedy at the Site. If a remedy is determined to be necessary to address sources of non-MGP-related impacts present at the Site, this will be evaluated separately for further action. Any necessary remediation will be completed prior to, or in association with, redevelopment. A Site Management Plan (SMP) will be prepared once the final remedy for the Site has been implemented. Periodic inspections of the Site will be conducted to assess compliance with the provisions of the Environmental Easement and this ISMP.

This ISMP has been prepared to manage impacts at the Site until the Environmental Easement is extinguished in accordance with Environmental Conservation Law (ECL) Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the Grantor of the Environmental Easement and the Grantor's successors and assigns. This ISMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This ISMP details the Site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the ISMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this ISMP is also a violation of ECL, 6 New York Codes, Rules, and Regulations (NYCRR) Part 375 and the Administrative Order on Consent (Index # A2-0552-0606; Site #224068) for the Site, and thereby subject to applicable penalties.
- The property owner is required to comply with this ISMP including all notifications to National Grid and provisions of the Excavation Work Plan (EWP) (Appendix B). National Grid is only responsible for costs associated with MGP-related impacts.

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

This ISMP was prepared by GEI Consultants, Inc., P.C. (GEI), on behalf of National Grid, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. The Record of Decision (ROD) required preparation of a SMP, however the NYSDEC referred to an ISMP in the November 4, 2015 letter providing requested modifications to the draft SMP. This ISMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site. **While National Grid has voluntarily assumed the costs of preparing this ISMP, National Grid reserves all of its rights under federal and state environmental laws to pursue other parties who may have responsibilities at this Site and for violations of the ISMP.**

As required by the March 31, 2015 ROD for the Site, this ISMP includes the following two plans:

- An Institutional and Engineering Control Plan that identifies all use restrictions and engineering controls for the Site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
    - Institutional Controls: an Environmental Easement; and
    - Engineering Controls: a cover system; and
- A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes:
    - A schedule of monitoring and frequency of submittals to the Department; and
    - Monitoring for vapor intrusion for any buildings developed on the Site, as may be required by the Institutional and Engineering Control Plan discussed above.

In addition, this ISMP includes the following:

- An Excavation Work Plan which details the provisions for management of limited excavations in areas of remaining impacts;
- Further investigation and possible remediation should large-scale redevelopment occur (see Section 1.4);
- Evaluation of the potential for Soil Vapor Intrusion (SVI) for any buildings developed on the Site, including provision for implementing actions recommended to address exposures related to SVI (see Section 7.1.2);
- Management and inspection of the identified engineering controls (see Section 3.3);
- Maintenance of Site access controls and Department notification.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager as an addendum. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements; removal of impacted soil; or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the ISMP, and append these notices to the ISMP that is retained in its files.

1.3 Notifications

Notifications shall be submitted, in writing, by the property owners to National Grid and, in writing, by National Grid to the NYSDEC, as needed, in accordance with NYSDEC's DER–10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under 6NYCRR Part 375 and/or ECL.
- 30-day advance notice of the start of any field activity associated with the related to maintenance to the building slab or construction not pursuant to the Excavation Work Plan.
- 60-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- 18-month advance notice of any large scale redevelopment.
- Once National Grid is made aware, notice will be provided to NYSDEC by noon the following day 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.
- Once National Grid is made aware, verbal notice will be provided to NYSDEC 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 seven days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any proposed change in the ownership of the Site, use of the Site, or the responsibility for implementing this ISMP will include the following notifications:

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

Table 2 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix C. See Figure 3 for notification requirements.

Plans for all intrusive activities must be approved by NYSDEC. Notification of intrusive activity must be made to NYSDEC sufficiently in advance of the activity for NYSDEC to make a decision on the reporting path to be followed. Typically, the reporting path and associated requirements depend on the size of intrusive activity. NYSDEC, once notified of the intrusive activity, will determine if the activity is either 1) small-scale (*i.e.*, “limited”) or 2) large-scale. Small-scale intrusive activities will comply with the Excavation Work Plan (Appendix B) and may require a Notice of Intrusion letter or a simple letter work plan. Requirements for large-scale intrusive activities are disused in Section 1.4.

1.4 Further Investigation and Possible Remedial Work Plan

Further investigation of the site will be required should large-scale redevelopment occur, if any of the existing structures are demolished, or if the subsurface is otherwise made accessible. The nature and extent, if any, of impacts in areas where access was previously limited or unavailable, will be investigated pursuant to a plan approved by the Department. Based on the investigation results and the Department's determination of the need for a remedy, a remedial work plan will be developed for the final remedy for MGP impacts at the Site and off-site areas, including removal and/or treatment of any source areas to the extent feasible. This removal or treatment will be sufficient in scope to address the Site as a source of both on-site and off-site groundwater impacts. The presumptive remedy for MGP contamination will be excavation of both former MGP structures and MGP-related source material, unless an alternative, equivalent remedy is developed based on new information. If a remedy is determined to be necessary to address sources of non-MGP-related impacts present at the Site, this will be evaluated separately for further action. A Citizen Participation Plan (CPP) will continue through this process. Any necessary remediation will be completed prior to, or in association with, redevelopment.

1.5 Prior Communications between National Grid, NYSDEC, and the Property Owner on Investigation Results and Responsibility for Environmental Conditions

On several occasions National Grid has communicated, either verbally or in writing, the results of the above-described investigations performed at the Site. On at least three occasions National Grid has provided reports and letters that discuss investigation findings to the property owners. One letter, dated July 17, 2011, was hand delivered to Emanual [sic] Roth of the Bedford Flushing Holding Corporation. The February 2012 Site Characterization (SC) Report was hand delivered to Moishe Roth on May 21, 2012. The March 2014 OU1 SC

Report was provided via email to Emanuel Roth on November 21, 2014 and hand delivered to Abraham Roth on December 18, 2014. Letters dated April 22 and April 29, 2016 discussing the results of the March 2016 Pre-Design Investigation (PDI) at 744 Bedford Avenue were sent to Mendal Roth of the Bedford Roth Holding Company.

The July 17, 2011 letter provided sub-slab soil vapor and air testing results for samples collected at 7 Skillman Street. Sub-slab soil vapor samples contained compounds that are common to MGP operations and petroleum products as well as chlorinated solvents, ethanol, and carbon disulfide. These results are described in more detail in Section 2.3.4.3 below. On July 18, 2011, Mr. Scott Deyette of NYSDEC Central Office sent an email to NYSDEC Region 2 providing this letter and stating, chlorinated compound detections "are obviously not MGP-related and National Grid will not be asked to determine their origin."

The April 22, 2016 letter provided data generated during the PDI and provided environmental requirements associated with working on the Site as part of the upcoming redevelopment. The April 29, 2016 letter provided additional geotechnical data generated during the PDI.

In addition, the NYSDEC sent a letter, dated May 9, 2016 to the legal counsel for the owners of the 7 Skillman Street and 744 Bedford Avenue properties. The intent of the letter was to "ensure that the owners of the properties are aware of the results of an investigation undertaken by National Grid in March 2016 and the implications of any redevelopment work to be undertaken." Key takeaways from the letter include:

"Construction that would result in the release of the perched groundwater inside the former Holder No. 1 tank would represent a significant environmental concern and a potential release condition".

"Work conducted on the Bedford Strip must be undertaken in accordance with an Interim Site Management Plan prepared for the K-Skillman Site. Excavation activities, including de-watering and disposal of impacted groundwater, must be undertaken in accordance with an Excavation Work Plan that will be included in the Interim Site Management Plan."

A copy of the May 9, 2016 NYSDEC letter is included in Appendix D. The Excavation Work Plan is included in Appendix B.

2. Summary of Previous Investigations and Remedial Actions

2.1 Site Location and Description

The Site is located in Brooklyn, Kings County, New York and is identified as Borough 3 Block 1886 and Lot 19 and a 10-foot by 90-foot strip (the Bedford Strip) on Lot 44 on the City of New York Tax Map (see Figure 1). The Site is an approximately 0.75-acre area, and is bounded by 5 Skillman Street to the north, 37 Skillman Street to the south, portions of 744 Bedford Avenue to the east, and Skillman Street to the west (see Figure 2 – Site Layout). The boundaries of the Site are more fully described in Appendix A – Environmental Easements. The owner(s) of the Site parcel(s) at the time of issuance of this ISMP is/are listed in Table 1 and shown in Figure 4.

2.2 Physical Setting

2.2.1 Land Use

The Site consists of the following: Lot 19 and a 10-foot by 90-foot portion of Lot 44. Lots 19 and 44 were formerly occupied by two connected buildings. The building on Lot 44 was demolished in 2015. The Site is zoned M1-2/R6A and is currently utilized for commercial purposes as a catering/banquet hall. Site occupants include a banquet hall.

The properties adjoining the Site and in the surrounding neighborhood, primarily include properties zoned for industrial, commercial, and residential uses. The property immediately south of the Site includes a property zoned for industrial use; the properties immediately north of the Site include properties zoned for commercial use; the properties immediately east of the Site include properties zoned for industrial, commercial, and residential uses; and the properties to the west of the Site include vacant properties and properties zoned for commercial use.

2.2.2 Geology

Surficial geology at the Site was assessed through visual inspection of soil samples collected during the field investigation. Soil was described according to the Unified Soil Classification System at each sampling location. Soil borings were installed to a maximum depth of approximately 45 feet below ground surface (bgs). Figure 5 shows sample locations, including the locations of soil borings, and locations of geologic cross section transects.

Geologic cross sections are shown in Figures 6 through 10. These cross sections also depict the observed physical impacts. The distribution of targeted compound and target analyte detections and visual observations are described in a later section. Detailed geologic descriptions are provided in boring logs (Appendix E).

During the SC, the presence of tanks for former Holders No. 1 and No. 2 was investigated. The presence of the Holder No. 1 tank was confirmed, with a bottom depth ranging from 22.0 to 24.0 feet bgs which is consistent with historic drawings. Based on historic drawings, Holder No. 2 had a flat bottom, built on grade with Skillman Street; the tank associated with Holder No. 2 was aboveground. No subsurface tank was encountered at the location of former Holder No. 2 during the SC.

Two borings, SSGP-07 and SSGP-08 were drilled within the former holder No. 1 tank, and fill material was encountered. Brick and coal fragments were observed at both locations. The two borings were refused at depths of 22 feet and 24 feet, respectively. One boring, SSGP-09 and an offset location SSGP-09B was drilled within the former holder No. 2 footprint, and the encountered material consisted of fill including brick fragments. The boring refused at 26 feet.

2.2.3 Hydrogeology

Of the eight monitoring wells installed during the SC, seven (SSMW-02 through SSMW-08) were installed in the vicinity of the Site. SSMW-01 was installed to the south. All wells except SSMW-06 were screened across the water table. Groundwater elevations ranged from 3.70 to 10.36 feet North American Vertical Datum (NAVD) 88 in wells screened across the water table. Perched water was observed within the former holder No. 1 tank, at a depth of approximately 10 feet bgs, or an elevation of approximately 12.3 feet NAVD. Table 3 presents a summary of measured depths to groundwater and groundwater elevations for the monitoring wells. A groundwater contour map is shown in Figure 11. Groundwater elevation data is provided in Table 3. Groundwater monitoring well construction logs are provided in Appendix E.

As part of the PDI, two temporary monitoring wells, SSGW-19 and SSGW-23, were installed and screened to straddle the water table on the Bedford Strip. Groundwater adjacent to Holder No. 1 was observed at depths approximately 15 to 16 feet bgs or approximately 2 feet NAVD 88. Based on this data and observations made during the SC of the groundwater depth within the holder tank, there appears to be an approximately 10-foot difference in elevation between the perched water inside the holder and groundwater table outside the holder.

In 1776, A stream and associated marsh was located north of the Site at the location of present day Flushing Avenue, (Marterer, 1925), and based on topography, nearby historical streams, and the East River, relative to the Site, the groundwater would be expected to flow in a northeasterly direction. However, the Site is located approximately 2,500 feet northwest of the Metropolitan Transit Authority (MTA) Marcy Avenue dewatering system which appears to influence the direction of local groundwater flow. West of the Site, groundwater flows towards the west, but groundwater at the Site and east of the Site flows southeast towards the MTA dewatering system.

2.3 Site and Investigation History

2.3.1 Holder Station History

The Site was the location of two water-sealed, gas holders, No. 1 and No. 2. The former holders operated solely as gas distribution holders. No gas production facilities were present at the Site according to the Sanborn maps and according to drawings of The Brooklyn Union Gas Company, on which the following construction details for the two holders are based. Holder No. 1, built prior to 1884, was comprised of three telescoping sections and had a rated capacity of 553,000 cubic feet. The sections were set in a subsurface, open, brick tank with a subgrade concrete foundation. The inner diameter of the tank is approximately 97 feet, and the maximum outside diameter, near the bottom of the tank, is approximately 105 feet. The bottom of the holder tank is approximately 22 feet below the elevation of Skillman Street. The tank had a convex bottom that is shallower in the center than at the perimeter. Holder No. 2, built circa 1891, was comprised of three telescoping sections and had a rated capacity of 539,000 cubic feet. The sections were set in an aboveground, open, steel tank built at grade. The inner diameter of the tank was approximately 92 feet, and the maximum outside diameter, at the top of the tank, was approximately 100 feet. The tank had a flat bottom, built on grade with Skillman Street. By August 1935, the two gas holders and the two small structures located in the southeastern and southwestern corners of the Skillman Holder site were no longer present. According to available records, the “standards” had been removed and the holders “shot”.

Prior to use as a holder station, the Site was developed with at least five structures by at least 1869. The uses of these structures are not known. By 1880, the Site had been divided into approximately nine or ten lots; however, the specific use of the lots was not reported. To the south, at 23 Skillman Street (an alternate address for the southern portion of the Site) and at 25 Skillman Street immediately south of the Site) were a stable and a “shoe shop” associated with the “Gutta Percha & Rubber Manufacturing Company”. A fire pump and portions of two horizontal boilers were present in the southeast corner of the shoe shop. On an 1886 map, there are no structures shown where the former shoe shop was previously located, and by 1887, according to the Sanborn map of that year, a structure attributed to the Gutta Percha & Rubber Manufacturing Co had been erected in its location.

The earliest maps available to National Grid show that the portions of the Skillman Street Holder Station at 7 Skillman Street and the Bedford Strip were first constructed between 1880 and 1884 and that the Site was owned and operated by The People’s Gas Light Company by at least 1884. Circa 1870, The People’s Gas Light Company had begun operation of its nearby works, located in Williamsburg along Wallabout Channel, between former South 10th Street and former South 11th Street. Based on available historical information and the date of construction, the works employed a coal carbonization process.

At that time the city of Brooklyn was being served with gas by several corporations. In the early 1880s, one of these, The Fulton Municipal Gas Company, manufacturing carbureted water gas with naphtha supplied by The Standard Oil Company, began a series of rate wars against other Brooklyn gas companies. Consistent with rate wars conducted by the Standard Oil Company as it gained domination of oil markets during the 1870s, the goal of the gas wars in Brooklyn would have been to eliminate competition and to create and control a market for Standard Oil products. Ultimately, a number of gas companies agreed to settlement terms with The Fulton Municipal Gas Company. In 1883, according to Progressive Age, The People's Gas Light Company agreed to cease making gas and "buy all it used from the Fulton Company", and in November 1883, American Gas Light Journal reported that "The 'public benefactors' over in Brooklyn" had "obtained control of the People's Company." The book History of Kings County, Including Brooklyn, N.Y., 1683-1883 reports that, following consolidation in the spring 1883, Henry Huttleston (H. H.) Rogers and William Rockefeller (both of The Standard Oil Company) were on the boards of The Fulton Municipal Gas Company and The People's Gas Light Company. In 1893, The Brooklyn Daily Eagle reported that in 1885, "The Standard Oil interest now controlled the Fulton Municipal [Gas Company] and… held one-third of the stock in… the People's [Gas Light Company]." Beginning in 1893, after the failure of consolidation attempts, and as the settlement agreements of the early 1880s were expiring, there was a second period of gas wars. This included a notable conflict between The Fulton Municipal Gas Company and The Williamsburg Gas Light Company which began in August with The Fulton Municipal Gas Company securing the lease of a holder from The People's Gas Light Company and laying mains in Williamsburg.

In 1895, The Brooklyn Union Gas Company was incorporated and acquired the properties of The Fulton Municipal Gas Company, The People's Gas Light Company, The Williamsburg Gas Light Company and four other Brooklyn gas companies. There was an interim board of directors for the first year of incorporation. E. R. Chapman, generally considered to be an agent of The Standard Oil Company, was elected Treasurer. At the November 1896 annual meeting, the elected directors included H. H. Rogers and William Rockefeller, with H. H. Rogers being elected vice-president, later in the month, at a meeting of the board of directors.

2.3.2 Post-Holder-Station History

The Site was owned by The Brooklyn Union Gas Company until August 5, 1940. By 1947 the Site was used for "auto parking" with the former meter room, offices, and boiler room used for automotive painting and repair. A square structure noted as containing "auto parts" was shown in the southeast corner of the Site and later removed by 1950. The 7 Skillman Street property continued to be used for auto repair until 1993. Documentation of the 7

Skillman Street property ownership between 1947 and 1968 is unclear; however, by 1968, it was owned by Manskill Realty Corp. and leased to Harper Motors Corp. In February 1985, it was deeded to Ram Realty Associates.

In December 27, 1993, the 7 Skillman Street property was acquired by Bedford-Flushing Holding Corp., the current property owner. From 1993 through 2002, the structures in the northern portion of the property continued to be used for auto repair; however, the majority of the site was identified as “Vac & Cl. Semi F.P.”. Available maps from 2003 through 2007 show that the portion of 7 Skillman Street previously used for auto repair had reportedly been converted into a commercial space. The majority of the property continued to be identified as “Semi F.P.”, a commercial operation. 7 Skillman Street is currently used as a catering hall; however, the date that this operation began has not yet been identified.

The Bedford Strip is immediately adjacent, to the east, of 7 Skillman Street and was vacant as of July 2016. Available Sanborn maps from 1950 to 1965 show the Bedford Strip, which was formerly included in the eastern portion of the 7 Skillman Street property, as its own parcel, separate and independent from the former 7 Skillman Street and 744 Bedford Avenue property lines. On the 1977 Sanborn map, the Bedford Strip is in the 744 Bedford Avenue property boundary. Based on a 2015 title search and current deed, the Bedford Strip is now part of the 744 Bedford Avenue property.

Except for the Bedford Strip, the property at 744 Bedford Avenue was used for residences beginning prior to 1887 through at least 1950. By 1965, until 1992, the entire 744 Bedford Avenue property was used for automobile parking and sales. Property use after 1993 was a catering hall. The catering hall building was demolished in 2015. Bedford Roth Holding, LLC sold the property to Bedford EMR Holdings, LLC on December 29, 2015.

2.3.3 Adjacent Parcels History

During the operation of the Skillman Street Holder Station the surrounding area was used for a mixture of residential, commercial, and industrial purposes. Specific property uses that have potentially contributed to the environmental impacts in and around the Site include a junkyard, The Gutta Percha & Rubber Manufacturing Company which operated as a reclamation plant, E.B. Stimpson Company which operated as a metal stamping and rivet manufacturer, as well as multiple automotive storage, servicing, and repair facilities.

Following the decommissioning of the Skillman Street Holder Station, surrounding property use continued to include a mixture of residential, commercial, and industrial uses. Specific property uses that have potentially contributed to the environmental impacts in and around the Site include fabric coating; a laundromat, the East Coast Industrial Uniform Corporation which operated as an industrial dry cleaning facility; as well as several gas stations, automotive storage, service, and repair facilities.

2.3.4 Investigation 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 - References.

A SC was performed at the Site from August 2010 through June 2013 and included characterizing the nature and extent of analytical detections and visual and olfactory observations at the 7 Skillman Street property. In November 2011, 7 Skillman Street was designated Operable Unit (OU) 1. Use of the OU 1 designation ceased with issuance of the PRAP in February 2015. The results of the SC are described in detail in the following reports:

- GEI Consultants, Inc., P.C., 2012. Site Characterization Report, Skillman Street Former Holder Station, Brooklyn, NY. February 2012.

- GEI Consultants, Inc., P.C., 2014. OU-1 Site Characterization Report, Skillman Street Former Holder Station, Brooklyn, NY. March 2014.

- Division of Environmental Remediation, New York State Department of Environmental Conservation, 2015. Proposed Remedial Action Plan, K - Skillman St. Station, State Superfund Project, Brooklyn, Kings County, Site No. 224068. February 2015.

- Division of Environmental Remediation, New York State Department of Environmental Conservation, 2015. Record of Decision, K - Skillman St. Station, State Superfund Project, Brooklyn, Kings County, Site No. 224068. March 2015.

In addition, GEI prepared and submitted a Draft PDI Data Summary Report for the Bedford Strip in Brooklyn, NY in May 2016.

2.3.5 Investigation Results

Below is a summary of Site conditions observed during performance of the SC and PDI from 2010 to 2016.

2.3.5.1 Soil

This section describes the soil conditions observed during the SC and PDI. Sampling of soil beneath the Site was limited due to the inability to access much of the property with a drill rig. Refer to Tables 4, 5, and 6 for the Analytical Soil Results and to Figures 12, 13, and 14 to see those results in figures.

- Benzene, toluene, ethylbenzene, and xylenes (BTEX) were detected at concentrations slightly exceeding Unrestricted Use Soil Cleanup Objectives (SCOs). Toluene, ethylbenzene, and total xylenes were detected at concentrations exceeding the Restricted Residential Use SCOs in one soil sample SSGP-02(26.7-28.3).

- There were no detections of chlorinated solvents or free cyanide above Unrestricted Use SCOs in soil samples.

- Polycyclic Aromatic Hydrocarbons (PAHs) detected at concentrations exceeding Restricted Use SCOs were benzo(b)fluoranthene, benz(a)anthracene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and naphthalene. These PAHs as well as chrysene were detected at concentrations exceeding Unrestricted Use SCOs.

- Inorganics detected at concentrations exceeding Unrestricted Use SCOs included copper, lead, mercury, nickel, and zinc, although none exceeded the Restricted Residential Use SCOs in soil samples. Metals were detected in all of the samples at concentrations consistent with typical background concentrations of metals in soil in the eastern United States.

2.3.5.2 Groundwater

This section describes the groundwater conditions observed during the SC. Refer to Table 7 for the Analytical Groundwater Results and to Figure 15 to see those results in a figure:

- Groundwater flow in the vicinity of the Site is toward the northwest. However, the subway dewatering system southeast of the Site appears to influence local groundwater flow (Figure 11). Depth to groundwater was approximately 7 to 15 feet below grade.

- BTEX and other VOCs, including chlorinated VOCs, were detected in groundwater at concentrations exceeding New York State Ambient Water Quality Standards (AWQS). Chlorinated solvents are not associated with holder station operations.

- Naphthalene and other Semi-Volatile Organic Compound (SVOCs) were detected in groundwater at concentrations exceeding the AWQSs.

- Total cyanide and metals were detected in groundwater at concentrations exceeding the AWQSs. Some of these metals are naturally occurring and most are not associated with holder station operations.

2.3.5.3 Soil Vapor Intrusion

The analytical results for ambient air, indoor air, and sub-slab soil vapor are summarized in Table 8. The ambient air, indoor air, and sub-slab soil vapor collected from the Site contained detections of both potentially MGP-related compounds and compounds known not to be MGP-related. Compounds that are potentially MGP-related could also be related to non-MGP sources. Chlorinated VOCs are not MGP-related as described in an email from NYSDEC (Appendix D).

The non-chlorinated VOC detections in sub-slab soil vapor included benzene at 35 $\mu g/m^3$; toluene at 96 $\mu g/m^3$; ethylbenzene at 12 $\mu g/m^3$; xylenes at 40 $\mu g/m^3$; 1,2,4- trimethylbenzene at 12 $\mu g/m^3$; and nonane at 8.4 $\mu g/m^3$. The chlorinated detections in sub-slab soil vapor included PCE at 12,000 $\mu g/m^3$, TCE at 1,200 $\mu g/m^3$, and cis-1,2 dichloroethene at 1,500 $\mu g/m^3$.

The non-chlorinated VOC constituents present in soil vapor were generally detected at much lower concentrations in indoor air, with the one exception being ethanol. The highest concentration of the BTEX compounds detected in indoor air was toluene, at 6.3 $\mu g/m^3$. PCE was detected at a concentration of 0.66 $\mu g/m^3$; TCE at 0.21 $\mu g/m^3$; and ethanol at 450 $\mu g/m^3$. Ethanol was detected in indoor air samples at concentrations approximately an order of magnitude larger than the soil vapor concentrations, indicating the source to be within the building. Ethanol and chlorinated VOCs, including PCE and TCE, are not associated with the former MGP operations. As previously mentioned in Section 1.5, NYSDEC stated National Grid would not be responsible for determining the origin of chlorinated impacts at the Site in an email to New York State Department of Health (NYSDOH) on July 18, 2011 (Appendix D).

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site, as listed in the ROD dated March 31, 2015, are as follows:

Groundwater

RAOs for Public Health Protection

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

RAOs for Environmental Protection

- Restore ground water aquifer to pre-disposal/pre-release conditions, to the extent practicable.
- Remove the source of ground or surface water contamination.

Soil

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

Soil Vapor

RAOs for Public Health Protection

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

3. Institutional and Engineering Control Plan

3.1 General

Since impacts remain 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 I SMP and is subject to revision by the NYSDEC.

This Institutional and Engineering Control Plan provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the restrictions set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the EWP (as provided in Appendix B) for the proper handling of impacted material that may be disturbed during small-scale (e.g., limited) intrusive work or activities on the Site;
- A decision tree outlining the steps for on-Site intrusive work by the property owners, included as Figure 3;
- A description of the roles and responsibilities of each party with respect to this ISMP, included as Table 9; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the Site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

One IC, an Environmental Easement, is required by the ROD to: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to impacts; and, (3) limit the use and development of the Site to restricted residential, commercial, and industrial uses only. Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this ISMP. Restrictions identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown in the figures associated with the Environmental Easement package included in Appendix A.

These ICs are:

- A requirement that the remedial party complete and submit to the Department a periodic certification of the institutional control (Environmental Easement) and the engineering control (Cover System) in accordance with Part 375 1.8(h)(3);

- An allowance for the use and development of the Site for restricted residential, commercial, and industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;

- A restriction on the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene (NYCDOHMH);

- A requirement that all future activities that will disturb impacts must be conducted in accordance with this ISMP;

- A requirement that access to the Site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement;

IC's may be modified, added or deleted from this list as warranted by site-specific conditions with approval with NYSDEC.

The responsibility for the elements of the Environmental Easement is discussed in Table 9 – Matrix of Responsibilities. Table 9 defines the responsibilities for National Grid and the property owner.

3.3 Engineering Controls

The Engineering Control is a Cover System for the Site. A site cover (a building at 7 Skillman Street and former building foundation slab at the Bedford Strip) currently exists and will be maintained to allow for restricted residential, commercial, or industrial use of the Site (Figure 16). Any site redevelopment or maintenance will maintain a site cover, which may consist either of 1) structures such as buildings, pavement, and sidewalks, or 2) a soil cover in areas where, in samples collected from the upper 2 feet of exposed soil, concentrations of detected target compounds and analytes would otherwise exceed the applicable SCOs. Where a soil cover is required it will be a minimum of 2 feet of soil, meeting at least the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, with the upper 6 inches of the soil of sufficient quality to maintain a vegetation layer. Any fill material brought to the Site will meet the requirements for the identified site use as set forth in 6 NYCRR Part 375-6.7(d).

The EW provided in Appendix B outlines the procedures required to be implemented in the event the Cover System is breached, penetrated or temporarily removed, and any underlying impacts are disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this ISMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) in Appendix F and associated Community Air Monitoring Plan (CAMP) prepared for the Site and provided in Appendix G.

4. Monitoring and Sampling Plan

4.1 General

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

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

- Sampling and analysis of all appropriate media (e.g., groundwater, indoor air, and soil vapor);
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards and Part 375 SCOs for soil, and NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York; 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 of this ISMP.

4.2 Site – wide Inspection

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

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

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

- Whether the EC continues to perform as designed;
- If the control continues to be protective of human health and the environment;
- Compliance with requirements of this ISMP and the Environmental Easement; and
- If records for the Site are complete and up to date.

Reporting requirements are outlined in Section 7 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 the EC occurs that reduces or has the potential to reduce the effectiveness of the EC in place at the Site, the property owner will notify National Grid as soon as possible. Once National Grid is notified, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within five days of the event (to the extent possible) to verify the effectiveness of the IC/ECs implemented at the Site by a QEP, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event (to the extent possible) that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Interim Media Monitoring and Sampling

Samples shall be collected from groundwater on a routine basis. Sampling locations, required analytical parameters, and schedule are provided in Table 10 – Sampling Requirements and Schedule. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

SVI sampling may also be conducted. The sampling requirements and schedule will be developed if an evaluation of the potential for SVI is required by NYSDEC.

4.3.1 Groundwater Sampling

Groundwater monitoring of the existing well network will be performed annually by National Grid's QEP to evaluate trends in groundwater quality in accordance with section 6.2.2 - Monitoring Plan of DER-10. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells has been installed to monitor upgradient and downgradient groundwater conditions around the Site.

Table 3 summarizes the monitoring well identification numbers and the purpose, location, depths, diameter and screened intervals of each well. As part of the groundwater monitoring, two upgradient wells, and five downgradient wells are sampled to monitor trends in groundwater quality (Figures 11 and 15). Groundwater sampling requirements and schedule are presented in Table 10.

Groundwater samples will be collected from the monitoring wells using low flow methods. Prior to sampling, groundwater elevations will be measured from each well to evaluate the groundwater flow beneath the Site. Investigation derived waste will be managed in 55-gallon United States Department of Transportation (USDOT) drums and will be disposed by National Grid following characterization. Detailed sample collection and analytical procedures and protocols are provided in Appendix I – Field Sampling Plan and Appendix H – QAPP. Detection limits and minimum reporting limits to be achieved by the Environmental Laboratory Approval Program (ELAP)-certified laboratory are also provided in the QAPP.

All wells except SSMW-06 are screened across the water table. Historically, groundwater elevations have ranged from 3.70 to 10.36 feet NAVD in wells screened across the water table. Table 3 presents a summary of measured depths to groundwater and groundwater elevation for the monitoring wells. Monitoring well construction logs are included in Appendix E of this document.

If biofouling or silt accumulation occurs in the Site monitoring wells, the wells will be physically agitated/surged and redeveloped by National Grid's QEP. Additionally, monitoring wells will be properly decommissioned and replaced by National Grid's QEP, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed by National Grid's QEP based on assessments of structural integrity and overall performance.

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

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

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

4.3.2 Soil Vapor Intrusion Sampling

Should it be determined by NYSDEC that, to evaluate the potential for SVI for any buildings developed on the Site, SVI sampling is required, SVI sampling will be performed at a frequency to be determined in consultation with NYSDEC. The property owner is responsible for sampling of chlorinated compounds.

The network of on-Site soil vapor intrusion sample locations will be designed based on the following criteria:

- Identification of a potential complete exposure pathway;
- Depth to groundwater below the planned foundation elements;
- Direction of groundwater flow from the contaminant source to the planned foundation elements; and,

- The location, depth, extent, and concentration of impacts in unsaturated soil and groundwater in the vicinity of the planned foundation elements.

Should it be determined by NYSDEC that SVI sampling is required, and a SVI sampling plan is developed, the sampling frequency may only be modified with the approval of the NYSDEC. This ISMP will be modified to reflect changes in sampling plans approved by the NYSDEC. If SVI sampling is required due to the presence of non-MGP contamination present at the site, this will be evaluated separately for further action.

Deliverables for the soil vapor intrusion sampling program, should one be developed, are specified in Section 7 – Reporting Requirements.

4.3.3 Monitoring and Sampling Protocol

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

5. Operation and Maintenance Plan

5.1 General

The Site remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this ISMP.

6. Periodic Assessments/Evaluations

6.1 Climate Change Vulnerability Assessment

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

A vulnerability assessment has not been prepared for the Site at the time of the preparation of the ISMP. A vulnerability assessment will not be conducted for the Site during periodic assessments.

6.2 Green Remediation Evaluation

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

6.2.1 Frequency of Sampling and Other Periodic Activities

Transportation to and from the Site and use of consumables in support of the Site visits/inspections, collection of samples, and shipment of samples to a laboratory for analyses have direct and/or inherent energy costs. The proposed schedule of sampling (once per year) will reduce expenditure of energy and resources, but not impact remedy protectiveness.

7. Reporting Requirements

7.1 Interim Site Management Monitoring/Inspection Reports

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

All applicable inspection forms and other records, including media sampling data, generated for the Site during the reporting period will be provided in electronic format to the NYSDEC by National Grid's QEP in accordance with the requirements of Table 11 and summarized in the PRR.

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., groundwater, sub-slab vapor, indoor air, outdoor air, etc);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and

- A determination as to whether contaminant conditions have changed since the last reporting event.

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

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

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

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

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

7.1.1 Groundwater Sampling Reports

At the completion of annual groundwater sampling activities, a report of the results will be provided to the NYSDEC, NYSDOH, and the property owner. The report will include a comparison of groundwater analytical data to the applicable SCGs.

7.1.2 Soil Vapor Intrusion Investigation Reports

At the completion of any soil vapor intrusion investigations conducted to assess conditions for future building development, a report of the results will be provided to the NYSDEC, NYSDOH, and the property owner. The report will include an evaluation of the soil vapor and indoor/outdoor air results against applicable matrices outlined in the *NYSDOH Guidance for Evaluation Soil Vapor Intrusion in the State of New York* and a comparison of indoor and outdoor analytical data to the 25th - 95th Percentile Range Background Indoor Air Concentrations presented in the *2006 NYSDOH Summary of Indoor and Outdoor Levels of Volatile Organic Compounds from Fuel Oil Heated Homes Reported in Various Locations within Sampled Homes in New York State*. The soil vapor analytical data will be compared to the indoor air concentrations for MGP-related impacts to determine if a potential complete exposure pathway is present for MGP-related impacts. If the data indicates that a potential complete exposure pathway is present for future construction, then the report will include recommendations for mitigation measures to be implemented during building construction in accordance with the ROD and the *NYSDOH Guidance for Evaluation Soil Vapor Intrusion in the State of New York.*

7.2 Periodic Review Report

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

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site.
- Results of the required annual Site inspections and severe condition inspections, if applicable.

- All applicable site management forms and other records generated for the Site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.

- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.

- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.

- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.

- A Site evaluation, which includes the following:

  - The compliance of the remedy with the requirements of the site-specific ROD;

  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;

  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and

  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the ROD.

  - The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, National Grid's QEP will prepare and include in the Periodic Review Report the following certification as per the requirements of NYSDEC DER-10:

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

- *The inspection of the Site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*

- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*

- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*

- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*

- *Access to the Site will continue to be provided to the Department and National Grid 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 system is performing as designed and is 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, [name], of [business address], am certifying as [National Grid or National Grid's Designated Site Representative]. I have been authorized and designated by National Grid to sign this certification for the Site."

The signed certification will be included in the PPR.

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

8. References

Division of Environmental Remediation New York State Department of Environmental Conservation, 2015. Proposed Remedial Action Plan, K - Skillman St. Station, State Superfund Project, Brooklyn, Kings County, Site No. 224068. February 2015.

Division of Environmental Remediation New York State Department of Environmental Conservation, 2015. Record of Decision, K - Skillman St. Station, State Superfund Project, Brooklyn, Kings County, Site No. 224068. March 2015.

GEI Consultants, Inc., P.C., 2016. Draft Pre-Design Investigation Data Summary Report, 744 Bedford Avenue Strip, Brooklyn, NY. May 2016.

GEI Consultants, Inc., P.C., 2014. OU-1 Site Characterization Report, Skillman Street Former Holder Station, Brooklyn, NY. March 2014.

GEI Consultants, Inc., P.C., 2012. Site Characterization Report, Skillman Street Former Holder Station, Brooklyn, NY. February 2012.

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

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

NYSDEC DER-31 – "Green Remediation".

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

Tables

Table 1. Site Property Divisions and Owners
Former Skillman Street Holder Station
Brooklyn, New York

Property Address	7 Skillman Street Brooklyn, NY 11205	744 Bedford Avenue Brooklyn, NY 11205 (includes the Bedford Strip)
Owner	Bedford-Flushing Holding Corp. c/o Mendel Roth 760 Bedford Avenue Brooklyn, NY 11205	Bedford EMR Holdings, LLC c/o Mendel Roth 760 Bedford Avenue Brooklyn, NY 11205
Occupant	Eden Palace, Inc. Ballroom/Banquet Facility	Vacant
Block and Lot Number	Block 1886 Lot 19	Block 1886 Lot 44
Current Zoning	M1-2/R6A	M1-2/R6A

Table 2. Notifications
Former Skillman Street Holder Station
Brooklyn, New York

Name	Contact Information
R. Scott Deyette NYSDEC Project Manager	(518) 402-9662 scott.deyette@dec.ny.gov
Paul John NYSDEC Regional HW Engineer	(718) 482-4931 paul.john@ dec.ny.gov
Kelly Lewandowski Chief, NYSDEC Site Control	(518) 402-9569 kelly.lewandowski@dec.ny.gov
Donald Campbell National Grid Project Manager	(718) 963-5453 donald.campbell@nationalgrid.com

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

Table 3. Monitoring Well Construction Summary and Groundwater Elevation Data
Former Skillman Street Holder Station
Brooklyn, New York

Well ID	Lithology of Screened Interval	Screened Interval (feet below ground surface)		Top of Screen Elevation (feet above NAVD)	Bottom of Screen Elevation (feet above NAVD)	Top of Casing Elevation (feet above NAVD)	Elevation at Center of Well Screen (feet above NAVD)
		Top of Screen	Bottom of Screen				
SSMW-02	Widely Graded Sand to Silty Sand	11.0	21.0	8.39	-1.61	19.00	3.39
SSMW-03	Silty Sand	12.0	22.0	5.72	-4.28	17.41	0.72
SSMW-04	Narrowly Graded Sand with Silt	10.0	20.0	6.11	-3.89	15.81	1.11
SSMW-05	Narrowly Graded Sand to Silty Sand	11.0	21.0	9.08	-0.92	19.68	4.08
SSMW-06	Silty Sand with Gravel	25.0	30.0	-6.14	-11.14	18.62	-8.64
SSMW-07	Narrowly Graded Sand with Silt to Silty Sand	7.0	17.0	7.03	-2.97	13.72	2.03
SSMW-08	Widely Graded Sand with Silt to Silty Sand	7.0	17.0	9.38	-0.62	16.38	4.38

Well ID	May 31 - June 1, 2011		June 14, 2011		September 9, 2011	
	Groundwater Depth from TOC (feet)	Groundwater Elevation (feet above NAVD)	Groundwater Depth from TOC (feet)	Groundwater Elevation (feet above NAVD)	Groundwater Depth from TOC (feet)	Groundwater Elevation (feet above NAVD)
SSMW-02	11.38	7.62	11.7	7.30	9.29	9.71
SSMW-03	9.38	8.03	9.37	8.04	7.05	10.36
SSMW-04	8.8	7.01	8.69	7.12	7.26	8.55
SSMW-05	15.98	3.70	14.98	4.70	13.51	6.17
SSMW-06	12.25	6.37	12.51	6.11	11.10	7.52
SSMW-07	NM	NC	NM	NC	6.94	6.78
SSMW-08	NM	NC	NM	NC	9.18	7.20

Notes:

Permanent monitoring wells were constructed using 2-inch PVC 0.010 inch slotted screens threaded to 2-inch Schedule 40 PVC riser.
NAVD - North American Vertical Datum
TOC - Top of Casing
NA - Not Applicable
NM - Not Measured
NC - Not Calculated

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010	SSGP-05 (0.5-5) 8/16/2010
BTEX (mg/kg)									
Benzene	0.06	4.8	**0.001 J**	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
Toluene	0.7	100	0.0057 U	**160**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
Ethylbenzene	1	41	0.0057 U	**220**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
o-Xylene	0.26	100	NA	NA	NA	NA	NA	NA	NA
m/p-Xylene	0.26	100	NA	NA	NA	NA	NA	NA	NA
Total Xylene	0.26	100	0.0057 U	**840**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
Total BTEX	NE	NE	**0.001**	**1220**	ND	ND	ND	ND	ND
Other VOCs (mg/kg)									
Acetone	0.05	100	**0.091 J**	58 UJ	0.022 U	0.023 UJ	0.024 U	0.023 U	0.024 UJ
Carbon disulfide	NE	NE	0.0057 U	23 U	0.0056 UJ	0.0057 U	0.006 UJ	0.0058 UJ	0.0059 U
1,2-Dichloroethane	0.02	3.1	0.0057 U	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
Isopropylbenzene	NE	NE	NA	NA	NA	NA	NA	NA	NA
Methylcyclohexane	NE	NE	NA	NA	NA	NA	NA	NA	NA
Methylene chloride	0.05	100	0.023 U	23 U	0.022 U	0.023 U	0.024 U	0.023 U	0.024 U
Styrene	NE	NE	0.0057 U	**400**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
Tetrachloroethene (PCE)	1.3	19	0.0057 U	23 U	0.0056 UJ	0.0057 U	0.006 U	0.0058 U	0.0059 U
Trichloroethene (TCE)	0.47	21	0.0057 U	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U
Total VOCs	NE	NE	**0.092**	**1620**	ND	ND	ND	ND	ND
PAHs (mg/kg)									
Acenaphthylene	100	100	0.31 U	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U
Anthracene	100	100	**0.018 J**	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U
Benzo(a)anthracene	1	1	**0.094 J**	63 U	**0.034 J**	0.31 U	0.32 U	**0.053 J**	0.32 U
Benzo(b)fluoranthene	1	1	**0.15 J**	63 U	**0.041 J**	0.31 U	0.32 U	**0.044 J**	0.32 U
Benzo(k)fluoranthene	0.8	3.9	**0.06 J**	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U
Benzo(g,h,i)perylene	100	100	**0.4**	63 U	**0.35 J**	0.31 UJ	0.32 U	**0.053 J**	0.32 U
Benzo(a)pyrene	1	1	**0.13 J**	63 U	**0.03 J**	0.31 U	0.32 U	**0.05 J**	0.32 U
Chrysene	1	3.9	**0.12 J**	63 U	**0.034 J**	0.31 U	0.32 U	**0.056 J**	0.32 U
Dibenz(a,h)anthracene	0.33	0.33	0.31 U	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U
Fluoranthene	100	100	**0.12 J**	63 U	**0.072 J**	0.31 U	0.32 U	0.31 U	0.32 U
Indeno(1,2,3-cd)pyrene	0.5	0.5	**0.23 J**	63 U	**0.16 J**	0.31 U	0.32 U	**0.05 J**	0.32 U
2-Methylnaphthalene	NE	NE	**0.15 J**	**170**	0.3 U	0.31 U	0.32 U	**0.016 J**	0.32 U
Naphthalene	12	100	**0.21 J**	**1000**	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U
Phenanthrene	100	100	**0.085 J**	**5.7 J**	**0.043 J**	0.31 U	0.32 U	**0.083 J**	0.32 U
Pyrene	100	100	**0.3 J**	**43 J**	**0.24 J**	0.31 U	0.32 U	**0.26 J**	0.32 UJ
Total PAH	NE	NE	**2.067**	**1218.7**	**1.004**	ND	ND	**0.665**	ND

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010	SSGP-05 (0.5-5) 8/16/2010
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	NE	0.31 UJ	63 U	0.3 U	0.31 U	0.32 U	0.31 U	**0.12 J**
Butyl benzyl phthalate	NE	NE	**0.046 J**	63 U	0.3 U	0.31 U	**0.021 J**	0.31 U	0.32 UJ
Total SVOCs	NE	NE	**2.113**	**1218.7**	**1.004**	ND	**0.021**	**0.665**	**0.12**
Metals (mg/kg)									
Aluminum	NE	NE	**13300**	**3770**	**11100**	**6550**	**14400**	**8870**	**12900**
Arsenic	13	16	**5.9 J**	**3 J**	**3.6 J**	**3 J**	**3.3 J**	**3.3 J**	**3.1 J**
Barium	350	400	**34.2 J**	**23.8 J**	**53.1 J**	**49.1 J**	**48.4**	**32 J**	**44.7 J**
Beryllium	7.2	72	**0.6 J**	**0.22 J**	**0.51 J**	**0.45 J**	**0.49 J**	**0.51 J**	**0.5 J**
Calcium	NE	NE	**1350**	**1260**	**7560**	**1300**	**1520**	**879**	**4750**
Chromium	NE	NE	**19.4 J**	**9.3 J**	**21.1 J**	**18.8 J**	**20 J**	**19.2 J**	**21.1 J**
Cobalt	NE	NE	**9.5 J**	**2.2**	**4.9**	**5.8**	**6.1**	**4.3**	**6.3**
Copper	50	270	**21.1**	**5.6**	**24.3 J**	**25.6 J**	**10.7 J**	**14.3 J**	**14.4 J**
Iron	NE	NE	**22300**	**8840**	**19500**	**16800**	**19800**	**22500**	**20200**
Lead	63	400	**16.5**	**3.8 J**	**14.3**	**5.2**	**9.3**	**27.1**	**8.7**
Magnesium	NE	NE	**2950**	**1620**	**3990**	**2170**	**2770**	**1800**	**3650**
Manganese	1600	2000	**259**	**231**	**160**	**246**	**433**	**155**	**296**
Mercury	0.18	0.81	0.072 U	0.054 U	0.052 U	0.051 U	0.055 U	**0.12**	0.057 U
Nickel	30	310	**16.4 J**	**8.6 J**	**14.8 J**	**12.1 J**	**14.7 J**	**11.4 J**	**13.2**
Potassium	NE	NE	**910**	**701**	**1470**	**1490**	**836**	**720**	**830**
Silver	2	180	**0.22 J**	**0.15 J**	**0.25 J**	**0.2 J**	1.3 U	1.3 U	1.5 U
Vanadium	NE	NE	**32 J**	**10 J**	**32.2 J**	**28.4 J**	**28.3**	**27.7 J**	**28 J**
Zinc	109	10000	**33.5**	**15.8**	**51.1**	**29.2**	**43.8**	**35.9**	**32.9**
Cyanides (mg/kg)									
Free Cyanide	NE	NE	0.23 U	0.23 U	0.22 U	0.23 U	0.24 U	0.23 U	0.24 U

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-05 (15) 8/16/2010	SSGP-06 (3-3.5) 6/27/2013	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013
BTEX (mg/kg)									
Benzene	0.06	4.8	0.0059 U	0.0012 UJ	0.0011 UJ	0.0011 UJ	**0.0013 J**	**0.0011 J**	0.0013 UJ
Toluene	0.7	100	0.0059 U	0.0012 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Ethylbenzene	1	41	0.0059 U	0.0012 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
o-Xylene	0.26	100	NA	0.0012 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
m/p-Xylene	0.26	100	NA	0.0023 UJ	0.0022 UJ	0.0022 UJ	0.0024 UJ	0.0023 UJ	0.0026 UJ
Total Xylene	0.26	100	0.0059 U	NA	NA	NA	NA	NA	NA
Total BTEX	NE	NE	ND	ND	ND	ND	**0.0013**	**0.0011**	ND
Other VOCs (mg/kg)									
Acetone	0.05	100	0.024 UJ	**0.027 J**	0.011 UJ	0.011 UJ	**0.015 J**	**0.013 J**	0.013 UJ
Carbon disulfide	NE	NE	0.0059 U	0.0012 UJ	0.0011 UJ	0.0011 UJ	**0.0015 J**	0.0011 UJ	0.0013 UJ
1,2-Dichloroethane	0.02	3.1	0.0059 U	**0.0015 J**	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Isopropylbenzene	NE	NE	NA	0.0012 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Methylcyclohexane	NE	NE	NA	0.0012 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Methylene chloride	0.05	100	0.024 U	**0.0028 J**	**0.0014 J**	0.0011 UJ	**0.018 J**	**0.015 J**	0.003 UJ
Styrene	NE	NE	0.0059 U	0.0012 UJ	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Tetrachloroethene (PCE)	1.3	19	0.0059 U	0.0012 UJ	**0.055 J**	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Trichloroethene (TCE)	0.47	21	0.0059 U	0.0012 UJ	**0.0022 J**	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ
Total VOCs	NE	NE	ND	**0.0313**	**0.0586**	ND	**0.0358**	**0.0291**	ND
PAHs (mg/kg)									
Acenaphthylene	100	100	0.32 U	0.37 U	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U
Anthracene	100	100	0.32 U	0.37 U	0.39 U	0.36 U	0.37 U	**0.5**	0.43 U
Benzo(a)anthracene	1	1	0.32 U	**0.92**	0.039 U	0.036 U	**0.85**	**1.3**	0.043 U
Benzo(b)fluoranthene	1	1	0.32 U	**1.1**	0.039 U	0.036 U	**1.1**	**1.5**	**0.055**
Benzo(k)fluoranthene	0.8	3.9	0.32 U	**0.48**	0.039 U	0.036 U	**0.4**	**0.5**	0.043 U
Benzo(g,h,i)perylene	100	100	0.32 U	0.37 U	0.39 U	0.36 U	**0.5**	**1.1**	0.43 U
Benzo(a)pyrene	1	1	0.32 U	**0.95**	0.039 U	0.036 U	**0.86**	**1.4**	0.043 U
Chrysene	1	3.9	0.32 U	**0.95**	0.39 U	0.36 U	**0.96**	**1.5**	0.43 U
Dibenz(a,h)anthracene	0.33	0.33	0.32 U	**0.097**	0.039 U	0.036 U	**0.058 J**	**0.18 J**	0.043 U
Fluoranthene	100	100	0.32 U	**2.1**	0.39 U	0.36 U	**1.9**	**3.1**	0.43 U
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.32 U	**0.39**	0.039 U	0.036 U	**0.61 J**	**1.2 J**	0.043 U
2-Methylnaphthalene	NE	NE	0.32 U	0.37 U	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U
Naphthalene	12	100	0.32 U	0.37 U	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U
Phenanthrene	100	100	0.32 U	**1.8**	0.39 U	0.36 U	**1.7**	**2.5**	0.43 U
Pyrene	100	100	0.32 UJ	**1.8**	0.39 U	0.36 U	**1.7**	**1.8**	0.43 U
Total PAH	NE	NE	ND	**10.587**	ND	ND	**10.638**	**16.58**	**0.055**

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-05 (15) 8/16/2010	SSGP-06 (3-3.5) 6/27/2013	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	NE	**0.061 J**	0.37 U	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U
Butyl benzyl phthalate	NE	NE	0.32 UJ	0.37 U	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U
Total SVOCs	NE	NE	**0.061**	**10.587**	ND	ND	**10.638**	**16.58**	**0.055**
Metals (mg/kg)									
Aluminum	NE	NE	**6090**	**7700**	**3800**	**5600**	**7600**	**8100**	**4700**
Arsenic	13	16	**3 J**	**5.9**	1.1 U	**1.5**	**5.6**	**7.8**	**2.1**
Barium	350	400	**68.4 J**	**91**	43 U	**53**	**190**	**210**	47 U
Beryllium	7.2	72	**0.53 J**	0.45 U	0.43 U	0.41 U	0.34 U	0.41 U	0.47 U
Calcium	NE	NE	**1340**	**28000**	1100 U	**1800**	**15000 J**	**29000 J**	**2200**
Chromium	NE	NE	**15.7 J**	**23 J**	**11 J**	**15 J**	**19 J**	**18 J**	**15 J**
Cobalt	NE	NE	**7.1**	11 U	11 U	10 U	**13**	10 U	12 U
Copper	50	270	**23.8 J**	**63**	**22**	**25**	**44**	**33**	**28**
Iron	NE	NE	**23300**	**20000**	**12000**	**17000**	**26000**	**28000**	**12000**
Lead	63	400	**5.3**	**160 J**	**4.6 J**	**7.1 J**	**270 J**	**330 J**	**56 J**
Magnesium	NE	NE	**2250**	**3600 J**	**1400 J**	**2500 J**	**2600 J**	**3500 J**	**6600 J**
Manganese	1600	2000	**469**	**610**	**110**	**260**	**340**	**450**	**190**
Mercury	0.18	0.81	0.058 U	**0.38**	0.02 U	0.018 U	**0.31**	**0.28**	**0.033**
Nickel	30	310	**11.8 J**	**31**	8.7 U	**11**	**21**	**20**	**69**
Potassium	NE	NE	**1080**	1100 U	1100 U	**1200**	**960**	**1400**	**1200**
Silver	2	180	1.5 U	2.2 U	2.2 U	2.1 U	1.7 U	2 U	2.3 U
Vanadium	NE	NE	**36.1 J**	**62**	**24**	**26**	**21**	**24**	**16**
Zinc	109	10000	**32.2**	**280**	**23**	**31**	**230**	**170**	**49**
Cyanides (mg/kg)									
Free Cyanide	NE	NE	0.24 U	2.5 U	2.5 U	2.3 U	2.4 U	2.4 U	2.7 U

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-07 (20-22) 6/26/2013	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013	SSGP-09 (3.0-3.4) 6/25/2013	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013	SSGP-14 (3-5) 8/9/2010
BTEX (mg/kg)									
Benzene	0.06	4.8	**0.61 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
Toluene	0.7	100	**12 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
Ethylbenzene	1	41	**29 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
o-Xylene	0.26	100	**11 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	NA
m/p-Xylene	0.26	100	**25 J**	0.0022 UJ	0.0025 UJ	0.0023 UJ	0.0025 UJ	0.0022 UJ	NA
Total Xylene	0.26	100	NA	NA	NA	NA	NA	NA	0.0059 U
Total BTEX	NE	NE	**77.61**	ND	ND	ND	ND	ND	ND
Other VOCs (mg/kg)									
Acetone	0.05	100	0.65 UJ	0.011 UJ	0.013 UJ	0.012 UJ	0.034 UJ	0.011 UJ	0.024 UJ
Carbon disulfide	NE	NE	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
1,2-Dichloroethane	0.02	3.1	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
Isopropylbenzene	NE	NE	**3.1 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	NA
Methylcyclohexane	NE	NE	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	NA
Methylene chloride	0.05	100	0.13 UJ	0.0035 UJ	0.0052 UJ	0.0053 UJ	0.0029 UJ	0.0013 UJ	0.024 U
Styrene	NE	NE	**0.14 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
Tetrachloroethene (PCE)	1.3	19	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
Trichloroethene (TCE)	0.47	21	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ	0.0013 UJ	0.0011 UJ	0.0059 U
Total VOCs	NE	NE	**80.85**	ND	ND	ND	ND	ND	ND
PAHs (mg/kg)									
Acenaphthylene	100	100	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Anthracene	100	100	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Benzo(a)anthracene	1	1	0.22 U	**0.075**	0.042 U	0.036 U	0.039 U	0.036 U	0.32 U
Benzo(b)fluoranthene	1	1	0.22 U	**0.079**	0.042 U	0.036 U	0.039 U	0.036 U	0.32 U
Benzo(k)fluoranthene	0.8	3.9	0.22 U	**0.038**	0.042 U	0.036 U	0.039 U	0.036 U	0.32 U
Benzo(g,h,i)perylene	100	100	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Benzo(a)pyrene	1	1	0.22 U	**0.075**	0.042 U	0.036 U	0.039 U	0.036 U	0.32 U
Chrysene	1	3.9	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Dibenz(a,h)anthracene	0.33	0.33	0.22 U	0.036 U	0.042 U	0.036 U	0.039 U	0.036 U	0.32 U
Fluoranthene	100	100	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.22 U	**0.071**	0.042 U	0.036 U	0.039 U	0.036 U	0.32 U
2-Methylnaphthalene	NE	NE	**8.1 J**	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Naphthalene	12	100	**38 J**	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Phenanthrene	100	100	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 U
Pyrene	100	100	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 UJ
Total PAH	NE	NE	**46.1**	**0.338**	ND	ND	ND	ND	ND

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-07 (20-22) 6/26/2013	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013	SSGP-09 (3.0-3.4) 6/25/2013	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013	SSGP-14 (3-5) 8/9/2010
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	NE	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 UJ
Butyl benzyl phthalate	NE	NE	2.2 U	0.36 U	0.42 U	0.36 U	0.39 U	0.36 U	0.32 UJ
Total SVOCs	NE	NE	**46.1**	**0.338**	ND	ND	ND	ND	ND
Metals (mg/kg)									
Aluminum	NE	NE	**8400**	**6700**	**9100**	**12000**	**8900**	**13000**	**15000**
Arsenic	13	16	**6.8**	**5.9**	**3.7**	**4**	**1.8**	**1.1 J**	**5.6 J**
Barium	350	400	**91**	**46**	**77**	**62**	**49**	**89**	**56.7 J**
Beryllium	7.2	72	0.44 U	0.39 U	0.42 U	**0.61**	**0.46**	**0.39**	**0.49 J**
Calcium	NE	NE	**5200**	**4300**	**15000**	**1900**	950 U	**2400**	**2920**
Chromium	NE	NE	**26 J**	**20 J**	**18 J**	**20 J**	**23 J**	**41 J**	**19.8 J**
Cobalt	NE	NE	11 U	**13**	10 U	**11**	9.5 U	**11**	**7.5 J**
Copper	50	270	**21**	**63**	**25**	**22**	**23**	**11**	**10.6**
Iron	NE	NE	**17000**	**18000**	**17000**	**23000**	**27000**	**28000**	**22300**
Lead	63	400	**160 J**	**330 J**	**73 J**	**46 J**	**7.6 J**	**4.4 J**	**10.4 J**
Magnesium	NE	NE	**4600 J**	**16000 J**	**6300 J**	**2500 J**	**3800 J**	**10000 J**	**2870**
Manganese	1600	2000	**290**	**290**	**460**	**440**	**680**	**310**	**706**
Mercury	0.18	0.81	**0.07**	**0.087**	0.021 U	**0.04**	0.02 U	0.018 U	0.054 U
Nickel	30	310	**41**	**170**	**36**	**17**	**14**	**24**	**12.9 J**
Potassium	NE	NE	**1200**	**1500**	**2100**	**1100**	**1600**	**8500**	**914**
Silver	2	180	2.2 U	1.9 U	2.1 U	1.7 U	1.9 U	1.7 U	**0.31 J**
Vanadium	NE	NE	**22**	**23**	**22**	**33**	**36**	**83**	**26.2 J**
Zinc	109	10000	**80**	**76**	**49**	**38**	**48**	**24**	**43.4**
Cyanides (mg/kg)									
Free Cyanide	NE	NE	2.9 U	**2.9**	2.6 U	2.4 U	2.6 U	2.4 U	0.24 U

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-14 (12.75-13) 8/9/2010	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010	SSGP-17 (10-12) 8/22/2011	SSGP-18 (10-12) 8/23/2011	SSSB-19 (7.5-8.5) 3/11/2016	Duplicate of SSSB-19 (7.5-8.5) 3/11/2016
BTEX (mg/kg)									
Benzene	0.06	4.8	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U	**0.0024**
Toluene	0.7	100	0.0067 U	0.0055 U	**0.00047 J**	0.0061 U	0.0056 U	0.00087 U	0.001 U
Ethylbenzene	1	41	0.0067 U	0.0055 U	**0.0017 J**	0.0061 U	0.0056 U	0.00087 U	0.001 U
o-Xylene	0.26	100	NA	NA	NA	NA	NA	0.00087 U	0.001 U
m/p-Xylene	0.26	100	NA	NA	NA	NA	NA	0.00087 U	0.001 U
Total Xylene	0.26	100	0.0067 U	0.0055 U	**0.013**	0.0061 U	0.0056 U	NA	NA
Total BTEX	NE	NE	ND	ND	**0.01517**	ND	ND	ND	**0.0024**
Other VOCs (mg/kg)									
Acetone	0.05	100	0.027 UJ	0.022 U	0.045 U	0.024 UJ	0.022 UJ	0.0043 U	0.005 U
Carbon disulfide	NE	NE	0.0067 U	0.0055 UJ	0.011 UJ	0.0061 U	0.0056 U	0.00087 U	0.001 U
1,2-Dichloroethane	0.02	3.1	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U	0.001 U
Isopropylbenzene	NE	NE	NA	NA	NA	NA	NA	0.00087 U	0.001 U
Methylcyclohexane	NE	NE	NA	NA	NA	NA	NA	0.00087 U	0.001 U
Methylene chloride	0.05	100	0.027 U	0.022 U	0.045 U	0.024 UJ	0.022 UJ	0.00087 U	0.001 U
Styrene	NE	NE	0.0067 U	0.0055 U	**0.011**	0.0061 U	0.0056 U	0.00087 U	0.001 U
Tetrachloroethene (PCE)	1.3	19	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	**0.0011**	**0.001**
Trichloroethene (TCE)	0.47	21	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U	0.001 U
Total VOCs	NE	NE	ND	ND	**0.02617**	ND	ND	**0.0011**	**0.0034**
PAHs (mg/kg)									
Acenaphthylene	100	100	0.36 U	0.29 U	**0.016 J**	0.32 U	0.29 U	0.99 U	0.22 U
Anthracene	100	100	**0.015 J**	0.29 U	0.3 U	0.32 U	**0.016 J**	0.99 U	0.22 U
Benzo(a)anthracene	1	1	**0.059 J**	0.29 U	0.3 U	**0.031 J**	**0.042 J**	0.99 U	0.22 U
Benzo(b)fluoranthene	1	1	**0.035 J**	0.29 U	0.3 U	0.32 UJ	**0.057 J**	0.99 U	0.22 U
Benzo(k)fluoranthene	0.8	3.9	0.36 U	0.29 U	0.3 U	0.32 UJ	0.29 UJ	0.99 U	0.22 U
Benzo(g,h,i)perylene	100	100	**0.41**	0.29 U	0.3 U	0.32 UJ	**0.16 J**	0.99 U	0.22 U
Benzo(a)pyrene	1	1	**0.047 J**	0.29 U	0.3 U	0.32 UJ	**0.036 J**	0.99 U	0.22 U
Chrysene	1	3.9	**0.053 J**	0.29 U	0.3 U	**0.024 J**	**0.068 J**	0.99 U	0.22 U
Dibenz(a,h)anthracene	0.33	0.33	0.36 U	0.29 U	0.3 U	0.32 UJ	0.29 UJ	0.99 U	0.22 U
Fluoranthene	100	100	**0.073 J**	0.29 U	0.3 U	**0.04 J**	**0.05 J**	0.99 U	0.22 U
Indeno(1,2,3-cd)pyrene	0.5	0.5	**0.19 J**	0.29 U	0.3 U	0.32 UJ	**0.13 J**	0.99 U	0.22 U
2-Methylnaphthalene	NE	NE	0.36 U	0.29 U	**0.27 J**	0.32 U	0.29 U	0.99 U	0.22 U
Naphthalene	12	100	0.36 U	0.29 U	**1.5**	0.32 U	0.29 U	0.99 U	0.22 U
Phenanthrene	100	100	0.36 U	0.29 U	0.3 U	0.32 U	**0.075 J**	0.99 U	0.22 U
Pyrene	100	100	**0.3 J**	0.29 UJ	0.3 UJ	**0.086 J**	**0.11 J**	0.99 U	0.22 U
Total PAH	NE	NE	**1.182**	ND	**1.786**	**0.181**	**0.744**	ND	ND

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSGP-14 (12.75-13) 8/9/2010	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010	SSGP-17 (10-12) 8/22/2011	SSGP-18 (10-12) 8/23/2011	SSSB-19 (7.5-8.5) 3/11/2016	Duplicate of SSSB-19 (7.5-8.5) 3/11/2016
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	NE	0.36 UJ	0.29 UJ	0.3 UJ	0.32 UJ	0.29 UJ	0.99 U	0.22 U
Butyl benzyl phthalate	NE	NE	0.36 UJ	0.29 UJ	0.3 UJ	0.32 UJ	0.29 UJ	0.99 U	0.22 U
Total SVOCs	NE	NE	**1.182**	ND	**1.786**	**0.181**	**0.744**	ND	ND
Metals (mg/kg)									
Aluminum	NE	NE	**10800**	**8120**	**3420**	NA	NA	**9200**	**6500**
Arsenic	13	16	**3.4 J**	**3.3 J**	5.7 U	NA	NA	3.3 U	3.4 U
Barium	350	400	**60.4 J**	**46.5 J**	**23.2 J**	NA	NA	**48**	45 U
Beryllium	7.2	72	**0.54 J**	**0.43 J**	**0.24 J**	NA	NA	**0.64**	**0.51**
Calcium	NE	NE	**1090**	**1190**	**690**	NA	NA	**12000**	**7300**
Chromium	NE	NE	**20.8 J**	**21.6 J**	**10.2 J**	NA	NA	**16**	**14**
Cobalt	NE	NE	**7.9**	**7.3**	**3.1**	NA	NA	11 U	11 U
Copper	50	270	**17.2 J**	**19.9 J**	**11**	NA	NA	**21**	**13**
Iron	NE	NE	**20400**	**19700**	**11600**	NA	NA	**19000**	**15000**
Lead	63	400	**5.1**	**5.7**	**3.3 J**	NA	NA	**23 J**	**11 J**
Magnesium	NE	NE	**3580**	**2880**	**1190**	NA	NA	**6100**	**4500**
Manganese	1600	2000	**228**	**343**	**131**	NA	NA	**500**	**390**
Mercury	0.18	0.81	0.064 U	0.054 U	0.053 U	NA	NA	**0.037**	0.02 U
Nickel	30	310	**20.3 J**	**14.1 J**	**7.7 J**	NA	NA	**17**	**12**
Potassium	NE	NE	**1810**	**1600**	**500**	NA	NA	1100 U	**1100**
Silver	2	180	**0.22 J**	1.3 U	1.4 U	NA	NA	2.2 U	2.2 U
Vanadium	NE	NE	**27.7 J**	**33.8 J**	**18.3 J**	NA	NA	**40**	**25**
Zinc	109	10000	**40.8**	**31.5**	**16.2**	NA	NA	**39**	**30**
Cyanides (mg/kg)									
Free Cyanide	NE	NE	0.27 U	0.22 U	0.22 U	NA	NA	2.5 U	2.6 U

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSSB-19 (13.5-15) 3/11/2016	SSSB-19 (33-34) 3/11/2016	SSSB-20 (23.5-24) 3/10/2016	SSSB-20 (33-34) 3/10/2016	SSSB-21 (21.5-22) 3/9/2016	SSSB-22 (20-23) 3/10/2016	SSSB-23 (32.5-33.5) 3/11/2016
BTEX (mg/kg)									
Benzene	0.06	4.8	0.00075 U	**0.016**	**0.0025**	**0.096**	**0.002**	0.0008 U	**0.019**
Toluene	0.7	100	0.00075 U	**0.0016**	**0.0013**	**0.076**	0.0007 U	0.0008 UJ	**0.0041**
Ethylbenzene	1	41	0.00075 U	**0.19**	0.00077 U	**0.48**	0.0007 U	0.0008 U	**0.087**
o-Xylene	0.26	100	0.00075 U	**0.017**	0.00077 U	**0.16**	0.0007 U	0.0008 U	**0.012**
m/p-Xylene	0.26	100	0.00075 U	**0.01**	0.00077 U	**0.33**	0.0007 U	0.0008 U	**0.015**
Total Xylene	0.26	100	NA	NA	NA	NA	NA	NA	NA
Total BTEX	NE	NE	ND	**0.2346**	**0.0038**	**1.142**	**0.002**	ND	**0.1371**
Other VOCs (mg/kg)									
Acetone	0.05	100	0.056 U	0.0035 U	0.015 U	0.19 U	0.0068 U	0.004 U	0.005 U
Carbon disulfide	NE	NE	0.00075 U	0.00071 U	**0.0014**	0.038 U	0.0007 U	**0.00081**	0.00076 U
1,2-Dichloroethane	0.02	3.1	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Isopropylbenzene	NE	NE	0.00075 U	**0.019**	0.00077 U	**0.058**	0.0007 U	0.0008 U	**0.01**
Methylcyclohexane	NE	NE	0.00075 U	**0.0012**	**0.00095**	0.038 U	0.0007 U	0.0008 U	**0.0024**
Methylene chloride	0.05	100	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Styrene	NE	NE	0.00075 U	0.00071 U	**0.00088**	0.038 U	**0.001**	0.0008 U	0.00076 U
Tetrachloroethene (PCE)	1.3	19	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Trichloroethene (TCE)	0.47	21	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Total VOCs	NE	NE	ND	**0.2548**	**0.00703**	**1.2**	**0.003**	**0.00081**	**0.1495**
PAHs (mg/kg)									
Acenaphthylene	100	100	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Anthracene	100	100	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(a)anthracene	1	1	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(b)fluoranthene	1	1	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(k)fluoranthene	0.8	3.9	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(g,h,i)perylene	100	100	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(a)pyrene	1	1	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Chrysene	1	3.9	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Dibenz(a,h)anthracene	0.33	0.33	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Fluoranthene	100	100	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Indeno(1,2,3-cd)pyrene	0.5	0.5	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
2-Methylnaphthalene	NE	NE	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Naphthalene	12	100	0.19 U	**0.69**	0.19 U	**1.2**	0.19 U	0.21 U	**0.42**
Phenanthrene	100	100	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Pyrene	100	100	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Total PAH	NE	NE	ND	**0.69**	ND	**1.2**	ND	ND	**0.42**

Table 4. Analytical Soil Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Restricted-Residential SCO	SSSB-19 (13.5-15) 3/11/2016	SSSB-19 (33-34) 3/11/2016	SSSB-20 (23.5-24) 3/10/2016	SSSB-20 (33-34) 3/10/2016	SSSB-21 (21.5-22) 3/9/2016	SSSB-22 (20-23) 3/10/2016	SSSB-23 (32.5-33.5) 3/11/2016
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	NE	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Butyl benzyl phthalate	NE	NE	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Total SVOCs	NE	NE	ND	**0.69**	ND	**1.2**	ND	ND	**0.42**
Metals (mg/kg)									
Aluminum	NE	NE	**7000**	**5900**	**6700**	**5900**	**9800**	**6200**	**6700**
Arsenic	13	16	3.3 U	3.4 U	3 U	3.4 U	2.8 U	3.7 U	3.3 U
Barium	350	400	**48**	**52**	40 U	**52**	**46**	**54**	**58**
Beryllium	7.2	72	**0.74**	**0.7**	**0.52**	**0.56**	**0.84**	0.49 U	**0.73**
Calcium	NE	NE	1100 U	**1400**	**2200**	**5200**	**3300**	**2700**	**2600**
Chromium	NE	NE	**32**	**18**	**21**	**19**	**24**	**11**	**22**
Cobalt	NE	NE	11 U	11 U	10 U	11 U	**9.7**	12 U	11 U
Copper	50	270	**24**	**21**	**14**	**21**	**21**	**19**	**26**
Iron	NE	NE	**25000**	**20000**	**18000**	**22000**	**25000**	**18000**	**25000**
Lead	63	400	**7.1**	**6.9**	**4.3**	**6.1**	**5.3**	**3**	**7.2**
Magnesium	NE	NE	**2400**	**2400**	**4200**	**2800**	**6200**	**1600**	**3200**
Manganese	1600	2000	**240**	**330**	**510**	**410**	**360**	**240**	**340**
Mercury	0.18	0.81	0.019 U	0.019 U	0.017 U	0.018 U	0.019 U	0.019 U	0.018 U
Nickel	30	310	**15**	**13**	**13**	**13**	**16**	9.8 U	**16**
Potassium	NE	NE	**1800**	**1600**	**1200**	**1600**	**3300**	**1900**	**2300**
Silver	2	180	2.2 U	2.3 U	2 U	2.3 U	1.9 U	2.5 U	2.2 U
Vanadium	NE	NE	**38**	**29**	**34**	**30**	**41**	**28**	**36**
Zinc	109	10000	**36**	**33**	**27**	**32**	**30**	**25**	**39**
Cyanides (mg/kg)									
Free Cyanide	NE	NE	2.4 U	2.2 U	2.4 U	2.2 U	1.8 U	2.4 U	2.1 U

Notes:

mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, and Total SVOCs are calculated using detects only.
Total PAHs are calculated using the following list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, 2-Methylnaphthalene, Naphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

ND = Not Detected
NE = Not Established
NA = Not Analyzed
NYSDEC = New York State Department of Environmental Conservation

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Gray shading and bolding indicates that the detected result value exceeds the Unrestricted SCO
Yellow shading and bolding indicates that the detected result value exceeds the Restricted-Residential SCO

Validation Qualifiers:
J = The result is an estimated value.
R = The result is rejected.
U = The result was not detected above the reporting limit.
UJ = The results were not detected at or above the reporting limit shown and the reporting limit is estimated.

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010	SSGP-06 (3-3.5) 6/27/2013
BTEX (mg/kg)										
Benzene	0.06	**0.001 J**	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Toluene	0.7	0.0057 U	**160**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Ethylbenzene	1	0.0057 U	**220**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
o-Xylene	0.26	NA	NA	NA	NA	NA	NA	NA	NA	0.0012 UJ
m/p-Xylene	0.26	NA	NA	NA	NA	NA	NA	NA	NA	0.0023 UJ
Total Xylene	0.26	0.0057 U	**840**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	NA
Total BTEX	NE	**0.001**	**1220**	ND	ND	ND	ND	ND	ND	ND
Other VOCs (mg/kg)										
Acetone	0.05	**0.091 J**	58 UJ	0.022 U	0.023 UJ	0.024 U	0.023 U	0.024 UJ	0.024 UJ	**0.027 J**
Carbon disulfide	NE	0.0057 U	23 U	0.0056 UJ	0.0057 U	0.006 UJ	0.0058 UJ	0.0059 U	0.0059 U	0.0012 UJ
1,2-Dichloroethane	0.02	0.0057 U	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	**0.0015 J**
Isopropylbenzene	NE	NA	NA	NA	NA	.	NA	NA	NA	0.0012 UJ
Methylcyclohexane	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0012 UJ
Methylene chloride	0.05	0.023 U	23 U	0.022 U	0.023 U	0.024 U	0.023 U	0.024 U	0.024 U	**0.0028 J**
Styrene	NE	0.0057 U	**400**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Tetrachloroethene (PCE)	1.3	0.0057 U	23 U	0.0056 UJ	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Trichloroethene (TCE)	0.47	0.0057 U	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Total VOCs	NE	**0.092**	**1620**	ND	ND	ND	ND	ND	ND	**0.0313**
PAHs (mg/kg)										
Acenaphthylene	100	0.31 U	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.37 U
Anthracene	100	**0.018 J**	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.37 U
Benzo(a)anthracene	1	**0.094 J**	63 U	**0.034 J**	0.31 U	0.32 U	**0.053 J**	0.32 U	0.32 U	**0.92**
Benzo(b)fluoranthene	1	**0.15 J**	63 U	**0.041 J**	0.31 U	0.32 U	**0.044 J**	0.32 U	0.32 U	**1.1**
Benzo(k)fluoranthene	0.8	**0.06 J**	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	**0.48**
Benzo(g,h,i)perylene	100	**0.4**	63 U	**0.35 J**	0.31 UJ	0.32 U	**0.053 J**	0.32 U	0.32 U	0.37 U
Benzo(a)pyrene	1	**0.13 J**	63 U	**0.03 J**	0.31 U	0.32 U	**0.05 J**	0.32 U	0.32 U	**0.95**
Chrysene	1	**0.12 J**	63 U	**0.034 J**	0.31 U	0.32 U	**0.056 J**	0.32 U	0.32 U	**0.95**
Dibenz(a,h)anthracene	0.33	0.31 U	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	**0.097**
Fluoranthene	100	**0.12 J**	63 U	**0.072 J**	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	**2.1**
Indeno(1,2,3-cd)pyrene	0.5	**0.23 J**	63 U	**0.16 J**	0.31 U	0.32 U	**0.05 J**	0.32 U	0.32 U	**0.39**
2-Methylnaphthalene	NE	**0.15 J**	**170**	0.3 U	0.31 U	0.32 U	**0.016 J**	0.32 U	0.32 U	0.37 U
Naphthalene	12	**0.21 J**	**1000**	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.37 U
Phenanthrene	100	**0.085 J**	**5.7 J**	**0.043 J**	0.31 U	0.32 U	**0.083 J**	0.32 U	0.32 U	**1.8**
Pyrene	100	**0.3 J**	**43 J**	**0.24 J**	0.31 U	0.32 U	**0.26 J**	0.32 UJ	0.32 UJ	**1.8**
Total PAH	NE	**2.067**	**1218.7**	**1.004**	ND	ND	**0.665**	ND	ND	**10.587**
Other SVOCs (mg/kg)										
Bis(2-ethylhexyl)phthalate	NE	0.31 UJ	63 U	0.3 U	0.31 U	0.32 U	0.31 U	**0.12 J**	**0.061 J**	0.37 U
Butyl benzyl phthalate	NE	**0.046 J**	63 U	0.3 U	0.31 U	**0.021 J**	0.31 U	0.32 UJ	0.32 UJ	0.37 U
Total SVOCs	NE	**2.113**	**1218.7**	**1.004**	ND	**0.021**	**0.665**	**0.12**	**0.061**	**10.587**

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010	SSGP-06 (3-3.5) 6/27/2013
Metals (mg/kg)										
Aluminum	NE	**13300**	**3770**	**11100**	**6550**	**14400**	**8870**	**12900**	**6090**	**7700**
Arsenic	13	**5.9 J**	**3 J**	**3.6 J**	**3 J**	**3.3 J**	**3.3 J**	**3.1 J**	**3 J**	**5.9**
Barium	350	**34.2 J**	**23.8 J**	**53.1 J**	**49.1 J**	**48.4**	**32 J**	**44.7 J**	**68.4 J**	**91**
Beryllium	7.2	**0.6 J**	**0.22 J**	**0.51 J**	**0.45 J**	**0.49 J**	**0.51 J**	**0.5 J**	**0.53 J**	0.45 U
Calcium	NE	**1350**	**1260**	**7560**	**1300**	**1520**	**879**	**4750**	**1340**	**28000**
Chromium	NE	**19.4 J**	**9.3 J**	**21.1 J**	**18.8 J**	**20 J**	**19.2 J**	**21.1 J**	**15.7 J**	**23 J**
Cobalt	NE	**9.5 J**	**2.2**	**4.9**	**5.8**	**6.1**	**4.3**	**6.3**	**7.1**	11 U
Copper	50	**21.1**	**5.6**	**24.3 J**	**25.6 J**	**10.7 J**	**14.3 J**	**14.4 J**	**23.8 J**	**63**
Iron	NE	**22300**	**8840**	**19500**	**16800**	**19800**	**22500**	**20200**	**23300**	**20000**
Lead	63	**16.5**	**3.8 J**	**14.3**	**5.2**	**9.3**	**27.1**	**8.7**	**5.3**	**160 J**
Magnesium	NE	**2950**	**1620**	**3990**	**2170**	**2770**	**1800**	**3650**	**2250**	**3600 J**
Manganese	1600	**259**	**231**	**160**	**246**	**433**	**155**	**296**	**469**	**610**
Mercury	0.18	0.072 U	0.054 U	0.052 U	0.051 U	0.055 U	**0.12**	0.057 U	0.058 U	**0.38**
Nickel	30	**16.4 J**	**8.6 J**	**14.8 J**	**12.1 J**	**14.7 J**	**11.4 J**	**13.2**	**11.8 J**	**31**
Potassium	NE	**910**	**701**	**1470**	**1490**	**836**	**720**	**830**	**1080**	1100 U
Silver	2	**0.22 J**	**0.15 J**	**0.25 J**	**0.2 J**	1.3 U	1.3 U	1.5 U	1.5 U	2.2 U
Vanadium	NE	**32 J**	**10 J**	**32.2 J**	**28.4 J**	**28.3**	**27.7 J**	**28 J**	**36.1 J**	**62**
Zinc	109	**33.5**	**15.8**	**51.1**	**29.2**	**43.8**	**35.9**	**32.9**	**32.2**	**280**
Cyanides (mg/kg)										
Free Cyanide	NE	0.23 U	0.23 U	0.22 U	0.23 U	0.24 U	0.23 U	0.24 U	0.24 U	2.5 U

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013	SSGP-09 (3.0-3.4) 6/25/2013
BTEX (mg/kg)										
Benzene	0.06	0.0011 UJ	0.0011 UJ	**0.0013 J**	**0.0011 J**	0.0013 UJ	**0.61 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Toluene	0.7	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**12 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Ethylbenzene	1	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**29 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
o-Xylene	0.26	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**11 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
m/p-Xylene	0.26	0.0022 UJ	0.0022 UJ	0.0024 UJ	0.0023 UJ	0.0026 UJ	**25 J**	0.0022 UJ	0.0025 UJ	0.0023 UJ
Total Xylene	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total BTEX	NE	ND	ND	**0.0013**	**0.0011**	ND	**77.61**	ND	ND	ND
Other VOCs (mg/kg)										
Acetone	0.05	0.011 UJ	0.011 UJ	**0.015 J**	**0.013 J**	0.013 UJ	0.65 UJ	0.011 UJ	0.013 UJ	0.012 UJ
Carbon disulfide	NE	0.0011 UJ	0.0011 UJ	**0.0015 J**	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
1,2-Dichloroethane	0.02	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Isopropylbenzene	NE	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**3.1 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Methylcyclohexane	NE	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Methylene chloride	0.05	**0.0014 J**	0.0011 UJ	**0.018 J**	**0.015 J**	0.003 UJ	0.13 UJ	0.0035 UJ	0.0052 UJ	0.0053 UJ
Styrene	NE	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**0.14 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Tetrachloroethene (PCE)	1.3	**0.055 J**	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Trichloroethene (TCE)	0.47	**0.0022 J**	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Total VOCs	NE	**0.0586**	ND	**0.0358**	**0.0291**	ND	**80.85**	ND	ND	ND
PAHs (mg/kg)										
Acenaphthylene	100	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Anthracene	100	0.39 U	0.36 U	0.37 U	**0.5**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Benzo(a)anthracene	1	0.039 U	0.036 U	**0.85**	**1.3**	0.043 U	0.22 U	**0.075**	0.042 U	0.036 U
Benzo(b)fluoranthene	1	0.039 U	0.036 U	**1.1**	**1.5**	**0.055**	0.22 U	**0.079**	0.042 U	0.036 U
Benzo(k)fluoranthene	0.8	0.039 U	0.036 U	**0.4**	**0.5**	0.043 U	0.22 U	**0.038**	0.042 U	0.036 U
Benzo(g,h,i)perylene	100	0.39 U	0.36 U	**0.5**	**1.1**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Benzo(a)pyrene	1	0.039 U	0.036 U	**0.86**	**1.4**	0.043 U	0.22 U	**0.075**	0.042 U	0.036 U
Chrysene	1	0.39 U	0.36 U	**0.96**	**1.5**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Dibenz(a,h)anthracene	0.33	0.039 U	0.036 U	**0.058 J**	**0.18 J**	0.043 U	0.22 U	0.036 U	0.042 U	0.036 U
Fluoranthene	100	0.39 U	0.36 U	**1.9**	**3.1**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Indeno(1,2,3-cd)pyrene	0.5	0.039 U	0.036 U	**0.61 J**	**1.2 J**	0.043 U	0.22 U	**0.071**	0.042 U	0.036 U
2-Methylnaphthalene	NE	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	**8.1 J**	0.36 U	0.42 U	0.36 U
Naphthalene	12	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	**38 J**	0.36 U	0.42 U	0.36 U
Phenanthrene	100	0.39 U	0.36 U	**1.7**	**2.5**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Pyrene	100	0.39 U	0.36 U	**1.7**	**1.8**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Total PAH	NE	ND	ND	**10.638**	**16.58**	**0.055**	**46.1**	**0.338**	ND	ND
Other SVOCs (mg/kg)										
Bis(2-ethylhexyl)phthalate	NE	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Butyl benzyl phthalate	NE	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Total SVOCs	NE	ND	ND	**10.638**	**16.58**	**0.055**	**46.1**	**0.338**	ND	ND

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013	SSGP-09 (3.0-3.4) 6/25/2013
Metals (mg/kg)										
Aluminum	NE	**3800**	**5600**	**7600**	**8100**	**4700**	**8400**	**6700**	**9100**	**12000**
Arsenic	13	1.1 U	**1.5**	**5.6**	**7.8**	**2.1**	**6.8**	**5.9**	**3.7**	**4**
Barium	350	43 U	**53**	**190**	**210**	47 U	**91**	**46**	**77**	**62**
Beryllium	7.2	0.43 U	0.41 U	0.34 U	0.41 U	0.47 U	0.44 U	0.39 U	0.42 U	**0.61**
Calcium	NE	1100 U	**1800**	**15000 J**	**29000 J**	**2200**	**5200**	**4300**	**15000**	**1900**
Chromium	NE	**11 J**	**15 J**	**19 J**	**18 J**	**15 J**	**26 J**	**20 J**	**18 J**	**20 J**
Cobalt	NE	11 U	10 U	**13**	10 U	12 U	11 U	**13**	10 U	**11**
Copper	50	**22**	**25**	**44**	**33**	**28**	**21**	**63**	**25**	**22**
Iron	NE	**12000**	**17000**	**26000**	**28000**	**12000**	**17000**	**18000**	**17000**	**23000**
Lead	63	**4.6 J**	**7.1 J**	**270 J**	**330 J**	**56 J**	**160 J**	**330 J**	**73 J**	**46 J**
Magnesium	NE	**1400 J**	**2500 J**	**2600 J**	**3500 J**	**6600 J**	**4600 J**	**16000 J**	**6300 J**	**2500 J**
Manganese	1600	**110**	**260**	**340**	**450**	**190**	**290**	**290**	**460**	**440**
Mercury	0.18	0.02 U	0.018 U	**0.31**	**0.28**	**0.033**	**0.07**	**0.087**	0.021 U	**0.04**
Nickel	30	8.7 U	**11**	**21**	**20**	**69**	**41**	**170**	**36**	**17**
Potassium	NE	1100 U	**1200**	**960**	**1400**	**1200**	**1200**	**1500**	**2100**	**1100**
Silver	2	2.2 U	2.1 U	1.7 U	2 U	2.3 U	2.2 U	1.9 U	2.1 U	1.7 U
Vanadium	NE	**24**	**26**	**21**	**24**	**16**	**22**	**23**	**22**	**33**
Zinc	109	**23**	**31**	**230**	**170**	**49**	**80**	**76**	**49**	**38**
Cyanides (mg/kg)										
Free Cyanide	NE	2.5 U	2.3 U	2.4 U	2.4 U	2.7 U	2.9 U	**2.9**	2.6 U	2.4 U

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010	SSGP-17 (10-12) 8/22/2011	SSGP-18 (10-12) 8/23/2011	SSSB-19 (7.5-8.5) 3/11/2016
BTEX (mg/kg)										
Benzene	0.06	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U
Toluene	0.7	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	**0.00047 J**	0.0061 U	0.0056 U	0.00087 U
Ethylbenzene	1	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	**0.0017 J**	0.0061 U	0.0056 U	0.00087 U
o-Xylene	0.26	0.0013 UJ	0.0011 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
m/p-Xylene	0.26	0.0025 UJ	0.0022 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
Total Xylene	0.26	NA	NA	0.0059 U	0.0067 U	0.0055 U	**0.013**	0.0061 U	0.0056 U	NA
Total BTEX	NE	ND	ND	ND	ND	ND	**0.01517**	ND	ND	ND
Other VOCs (mg/kg)										
Acetone	0.05	0.034 UJ	0.011 UJ	0.024 UJ	0.027 UJ	0.022 U	0.045 U	0.024 UJ	0.022 UJ	0.0043 U
Carbon disulfide	NE	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 UJ	0.011 UJ	0.0061 U	0.0056 U	0.00087 U
1,2-Dichloroethane	0.02	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U
Isopropylbenzene	NE	0.0013 UJ	0.0011 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
Methylcyclohexane	NE	0.0013 UJ	0.0011 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
Methylene chloride	0.05	0.0029 UJ	0.0013 UJ	0.024 U	0.027 U	0.022 U	0.045 U	0.024 UJ	0.022 UJ	0.00087 U
Styrene	NE	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	**0.011**	0.0061 U	0.0056 U	0.00087 U
Tetrachloroethene (PCE)	1.3	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	**0.0011**
Trichloroethene (TCE)	0.47	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U
Total VOCs	NE	ND	ND	ND	ND	ND	**0.02617**	ND	ND	**0.0011**
PAHs (mg/kg)										
Acenaphthylene	100	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	**0.016 J**	0.32 U	0.29 U	0.99 U
Anthracene	100	0.39 U	0.36 U	0.32 U	**0.015 J**	0.29 U	0.3 U	0.32 U	**0.016 J**	0.99 U
Benzo(a)anthracene	1	0.039 U	0.036 U	0.32 U	**0.059 J**	0.29 U	0.3 U	**0.031 J**	**0.042 J**	0.99 U
Benzo(b)fluoranthene	1	0.039 U	0.036 U	0.32 U	**0.035 J**	0.29 U	0.3 U	0.32 UJ	**0.057 J**	0.99 U
Benzo(k)fluoranthene	0.8	0.039 U	0.036 U	0.32 U	0.36 U	0.29 U	0.3 U	0.32 UJ	0.29 UJ	0.99 U
Benzo(g,h,i)perylene	100	0.39 U	0.36 U	0.32 U	**0.41**	0.29 U	0.3 U	0.32 UJ	**0.16 J**	0.99 U
Benzo(a)pyrene	1	0.039 U	0.036 U	0.32 U	**0.047 J**	0.29 U	0.3 U	0.32 UJ	**0.036 J**	0.99 U
Chrysene	1	0.39 U	0.36 U	0.32 U	**0.053 J**	0.29 U	0.3 U	**0.024 J**	**0.068 J**	0.99 U
Dibenz(a,h)anthracene	0.33	0.039 U	0.036 U	0.32 U	0.36 U	0.29 U	0.3 U	0.32 UJ	0.29 UJ	0.99 U
Fluoranthene	100	0.39 U	0.36 U	0.32 U	**0.073 J**	0.29 U	0.3 U	**0.04 J**	**0.05 J**	0.99 U
Indeno(1,2,3-cd)pyrene	0.5	0.039 U	0.036 U	0.32 U	**0.19 J**	0.29 U	0.3 U	0.32 UJ	**0.13 J**	0.99 U
2-Methylnaphthalene	NE	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	**0.27 J**	0.32 U	0.29 U	0.99 U
Naphthalene	12	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	**1.5**	0.32 U	0.29 U	0.99 U
Phenanthrene	100	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	0.3 U	0.32 U	**0.075 J**	0.99 U
Pyrene	100	0.39 U	0.36 U	0.32 UJ	**0.3 J**	0.29 UJ	0.3 UJ	**0.086 J**	**0.11 J**	0.99 U
Total PAH	NE	ND	ND	ND	**1.182**	ND	**1.786**	**0.181**	**0.744**	ND
Other SVOCs (mg/kg)										
Bis(2-ethylhexyl)phthalate	NE	0.39 U	0.36 U	0.32 UJ	0.36 UJ	0.29 UJ	0.3 UJ	0.32 UJ	0.29 UJ	0.99 U
Butyl benzyl phthalate	NE	0.39 U	0.36 U	0.32 UJ	0.36 UJ	0.29 UJ	0.3 UJ	0.32 UJ	0.29 UJ	0.99 U
Total SVOCs	NE	ND	ND	ND	**1.182**	ND	**1.786**	**0.181**	**0.744**	ND

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010	SSGP-17 (10-12) 8/22/2011	SSGP-18 (10-12) 8/23/2011	SSSB-19 (7.5-8.5) 3/11/2016
Metals (mg/kg)										
Aluminum	NE	**8900**	**13000**	**15000**	**10800**	**8120**	**3420**	NA	NA	**9200**
Arsenic	13	**1.8**	**1.1 J**	**5.6 J**	**3.4 J**	**3.3 J**	5.7 U	NA	NA	3.3 U
Barium	350	**49**	**89**	**56.7 J**	**60.4 J**	**46.5 J**	**23.2 J**	NA	NA	**48**
Beryllium	7.2	**0.46**	**0.39**	**0.49 J**	**0.54 J**	**0.43 J**	**0.24 J**	NA	NA	**0.64**
Calcium	NE	950 U	**2400**	**2920**	**1090**	**1190**	**690**	NA	NA	**12000**
Chromium	NE	**23 J**	**41 J**	**19.8 J**	**20.8 J**	**21.6 J**	**10.2 J**	NA	NA	**16**
Cobalt	NE	9.5 U	**11**	**7.5 J**	**7.9**	**7.3**	**3.1**	NA	NA	11 U
Copper	50	**23**	**11**	**10.6**	**17.2 J**	**19.9 J**	**11**	NA	NA	**21**
Iron	NE	**27000**	**28000**	**22300**	**20400**	**19700**	**11600**	NA	NA	**19000**
Lead	63	**7.6 J**	**4.4 J**	**10.4 J**	**5.1**	**5.7**	**3.3 J**	NA	NA	**23 J**
Magnesium	NE	**3800 J**	**10000 J**	**2870**	**3580**	**2880**	**1190**	NA	NA	**6100**
Manganese	1600	**680**	**310**	**706**	**228**	**343**	**131**	NA	NA	**500**
Mercury	0.18	0.02 U	0.018 U	0.054 U	0.064 U	0.054 U	0.053 U	NA	NA	**0.037**
Nickel	30	**14**	**24**	**12.9 J**	**20.3 J**	**14.1 J**	**7.7 J**	NA	NA	**17**
Potassium	NE	**1600**	**8500**	**914**	**1810**	**1600**	**500**	NA	NA	1100 U
Silver	2	1.9 U	1.7 U	**0.31 J**	**0.22 J**	1.3 U	1.4 U	NA	NA	2.2 U
Vanadium	NE	**36**	**83**	**26.2 J**	**27.7 J**	**33.8 J**	**18.3 J**	NA	NA	**40**
Zinc	109	**48**	**24**	**43.4**	**40.8**	**31.5**	**16.2**	NA	NA	**39**
Cyanides (mg/kg)										
Free Cyanide	NE	2.6 U	2.4 U	0.24 U	0.27 U	0.22 U	0.22 U	NA	NA	2.5 U

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Unrestricted SCO	Duplicate of SSSB-19 (7.5-8.5) 3/11/2016	SSSB-19 (13.5-15) 3/11/2016	SSSB-19 (33-34) 3/11/2016	SSSB-20 (23.5-24) 3/10/2016	SSSB-20 (33-34) 3/10/2016	SSSB-21 (21.5-22) 3/9/2016	SSSB-22 (20-23) 3/10/2016	SSSB-23 (32.5-33.5) 3/11/2016
BTEX (mg/kg)									
Benzene	0.06	**0.0024**	0.00075 U	**0.016**	**0.0025**	**0.096**	**0.002**	0.0008 U	**0.019**
Toluene	0.7	0.001 U	0.00075 U	**0.0016**	**0.0013**	**0.076**	0.0007 U	0.0008 UJ	**0.0041**
Ethylbenzene	1	0.001 U	0.00075 U	**0.19**	0.00077 U	**0.48**	0.0007 U	0.0008 U	**0.087**
o-Xylene	0.26	0.001 U	0.00075 U	**0.017**	0.00077 U	**0.16**	0.0007 U	0.0008 U	**0.012**
m/p-Xylene	0.26	0.001 U	0.00075 U	**0.01**	0.00077 U	**0.33**	0.0007 U	0.0008 U	**0.015**
Total Xylene	0.26	NA	NA	NA	NA	NA	NA	NA	NA
Total BTEX	NE	**0.0024**	ND	**0.2346**	**0.0038**	**1.142**	**0.002**	ND	**0.1371**
Other VOCs (mg/kg)									
Acetone	0.05	0.005 U	0.056 U	0.0035 U	0.015 U	0.19 U	0.0068 U	0.004 U	0.005 U
Carbon disulfide	NE	0.001 U	0.00075 U	0.00071 U	**0.0014**	0.038 U	0.0007 U	**0.00081**	0.00076 U
1,2-Dichloroethane	0.02	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Isopropylbenzene	NE	0.001 U	0.00075 U	**0.019**	0.00077 U	**0.058**	0.0007 U	0.0008 U	**0.01**
Methylcyclohexane	NE	0.001 U	0.00075 U	**0.0012**	**0.00095**	0.038 U	0.0007 U	0.0008 U	**0.0024**
Methylene chloride	0.05	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Styrene	NE	0.001 U	0.00075 U	0.00071 U	**0.00088**	0.038 U	**0.001**	0.0008 U	0.00076 U
Tetrachloroethene (PCE)	1.3	**0.001**	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Trichloroethene (TCE)	0.47	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Total VOCs	NE	**0.0034**	ND	**0.2548**	**0.00703**	**1.2**	**0.003**	**0.00081**	**0.1495**
PAHs (mg/kg)									
Acenaphthylene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Anthracene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(a)anthracene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(b)fluoranthene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(k)fluoranthene	0.8	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(g,h,i)perylene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(a)pyrene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Chrysene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Dibenz(a,h)anthracene	0.33	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Fluoranthene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Indeno(1,2,3-cd)pyrene	0.5	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
2-Methylnaphthalene	NE	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Naphthalene	12	0.22 U	0.19 U	**0.69**	0.19 U	**1.2**	0.19 U	0.21 U	**0.42**
Phenanthrene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Pyrene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Total PAH	NE	ND	ND	**0.69**	ND	**1.2**	ND	ND	**0.42**
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Butyl benzyl phthalate	NE	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Total SVOCs	NE	ND	ND	**0.69**	ND	**1.2**	ND	ND	**0.42**

Table 5. Summary of Soil Impacts Above Unrestricted Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Unrestricted SCO	Duplicate of SSSB-19 (7.5-8.5) 3/11/2016	SSSB-19 (13.5-15) 3/11/2016	SSSB-19 (33-34) 3/11/2016	SSSB-20 (23.5-24) 3/10/2016	SSSB-20 (33-34) 3/10/2016	SSSB-21 (21.5-22) 3/9/2016	SSSB-22 (20-23) 3/10/2016	SSSB-23 (32.5-33.5) 3/11/2016
Metals (mg/kg)									
Aluminum	NE	**6500**	**7000**	**5900**	**6700**	**5900**	**9800**	**6200**	**6700**
Arsenic	13	3.4 U	3.3 U	3.4 U	3 U	3.4 U	2.8 U	3.7 U	3.3 U
Barium	350	45 U	**48**	**52**	40 U	**52**	**46**	**54**	**58**
Beryllium	7.2	**0.51**	**0.74**	**0.7**	**0.52**	**0.56**	**0.84**	0.49 U	**0.73**
Calcium	NE	**7300**	1100 U	**1400**	**2200**	**5200**	**3300**	**2700**	**2600**
Chromium	NE	**14**	**32**	**18**	**21**	**19**	**24**	**11**	**22**
Cobalt	NE	11 U	11 U	11 U	10 U	11 U	**9.7**	12 U	11 U
Copper	50	**13**	**24**	**21**	**14**	**21**	**21**	**19**	**26**
Iron	NE	**15000**	**25000**	**20000**	**18000**	**22000**	**25000**	**18000**	**25000**
Lead	63	**11 J**	**7.1**	**6.9**	**4.3**	**6.1**	**5.3**	**3**	**7.2**
Magnesium	NE	**4500**	**2400**	**2400**	**4200**	**2800**	**6200**	**1600**	**3200**
Manganese	1600	**390**	**240**	**330**	**510**	**410**	**360**	**240**	**340**
Mercury	0.18	0.02 U	0.019 U	0.019 U	0.017 U	0.018 U	0.019 U	0.019 U	0.018 U
Nickel	30	**12**	**15**	**13**	**13**	**13**	**16**	9.8 U	**16**
Potassium	NE	**1100**	**1800**	**1600**	**1200**	**1600**	**3300**	**1900**	**2300**
Silver	2	2.2 U	2.2 U	2.3 U	2 U	2.3 U	1.9 U	2.5 U	2.2 U
Vanadium	NE	**25**	**38**	**29**	**34**	**30**	**41**	**28**	**36**
Zinc	109	**30**	**36**	**33**	**27**	**32**	**30**	**25**	**39**
Cyanides (mg/kg)									
Free Cyanide	NE	2.6 U	2.4 U	2.2 U	2.4 U	2.2 U	1.8 U	2.4 U	2.1 U

Notes:

mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, and Total SVOCs are calculated using detects only.
Total PAHs are calculated using the following list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, 2-Methylnaphthalene, Naphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

ND = Not Detected
NE = Not Established
NA = Not Analyzed
NYSDEC = New York State Department of Environmental Conservation

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Gray shading and bolding indicates that the detected result value exceeds the Unrestricted SCO

Validation Qualifiers:
J = The result is an estimated value.
R = The result is rejected.
U = The result was not detected above the reporting limit.
UJ = The results were not detected at or above the reporting limit shown and the reporting limit is estimated.

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Restricted-Residential SCO	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010	SSGP-06 (3-3.5) 6/27/2013
BTEX (mg/kg)										
Benzene	4.8	**0.001 J**	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Toluene	100	0.0057 U	**160**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Ethylbenzene	41	0.0057 U	**220**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
o-Xylene	100	NA	NA	NA	NA	NA	NA	NA	NA	0.0012 UJ
m/p-Xylene	100	NA	NA	NA	NA	NA	NA	NA	NA	0.0023 UJ
Total Xylene	100	0.0057 U	**840**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	NA
Total BTEX	NE	**0.001**	**1220**	ND	ND	ND	ND	ND	ND	ND
Other VOCs (mg/kg)										
Acetone	100	**0.091 J**	58 UJ	0.022 U	0.023 UJ	0.024 U	0.023 U	0.024 UJ	0.024 UJ	**0.027 J**
Carbon disulfide	NE	0.0057 U	23 U	0.0056 UJ	0.0057 U	0.006 UJ	0.0058 UJ	0.0059 U	0.0059 U	0.0012 UJ
1,2-Dichloroethane	3.1	0.0057 U	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	**0.0015 J**
Isopropylbenzene	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0012 UJ
Methylcyclohexane	NE	NA	NA	NA	NA	NA	NA	NA	NA	0.0012 UJ
Methylene chloride	100	0.023 U	23 U	0.022 U	0.023 U	0.024 U	0.023 U	0.024 U	0.024 U	**0.0028 J**
Styrene	NE	0.0057 U	**400**	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Tetrachloroethene (PCE)	19	0.0057 U	23 U	0.0056 UJ	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Trichloroethene (TCE)	21	0.0057 U	23 U	0.0056 U	0.0057 U	0.006 U	0.0058 U	0.0059 U	0.0059 U	0.0012 UJ
Total VOCs	NE	**0.092**	**1620**	ND	ND	ND	ND	ND	ND	**0.0313**
PAHs (mg/kg)										
Acenaphthylene	100	0.31 U	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.37 U
Anthracene	100	**0.018 J**	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.37 U
Benzo(a)anthracene	1	**0.094 J**	63 U	**0.034 J**	0.31 U	0.32 U	**0.053 J**	0.32 U	0.32 U	**0.92**
Benzo(b)fluoranthene	1	**0.15 J**	63 U	**0.041 J**	0.31 U	0.32 U	**0.044 J**	0.32 U	0.32 U	**1.1**
Benzo(k)fluoranthene	3.9	**0.06 J**	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	**0.48**
Benzo(g,h,i)perylene	100	**0.4**	63 U	**0.35 J**	0.31 UJ	0.32 U	**0.053 J**	0.32 U	0.32 U	0.37 U
Benzo(a)pyrene	1	**0.13 J**	63 U	**0.03 J**	0.31 U	0.32 U	**0.05 J**	0.32 U	0.32 U	**0.95**
Chrysene	3.9	**0.12 J**	63 U	**0.034 J**	0.31 U	0.32 U	**0.056 J**	0.32 U	0.32 U	**0.95**
Dibenz(a,h)anthracene	0.33	0.31 U	63 U	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	**0.097**
Fluoranthene	100	**0.12 J**	63 U	**0.072 J**	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	**2.1**
Indeno(1,2,3-cd)pyrene	0.5	**0.23 J**	63 U	**0.16 J**	0.31 U	0.32 U	**0.05 J**	0.32 U	0.32 U	**0.39**
2-Methylnaphthalene	NE	**0.15 J**	**170**	0.3 U	0.31 U	0.32 U	**0.016 J**	0.32 U	0.32 U	0.37 U
Naphthalene	100	**0.21 J**	**1000**	0.3 U	0.31 U	0.32 U	0.31 U	0.32 U	0.32 U	0.37 U
Phenanthrene	100	**0.085 J**	**5.7 J**	**0.043 J**	0.31 U	0.32 U	**0.083 J**	0.32 U	0.32 U	**1.8**
Pyrene	100	**0.3 J**	**43 J**	**0.24 J**	0.31 U	0.32 U	**0.26 J**	0.32 UJ	0.32 UJ	**1.8**
Total PAH	NE	**2.067**	**1218.7**	**1.004**	ND	ND	**0.665**	ND	ND	**10.587**
Other SVOCs (mg/kg)										
Bis(2-ethylhexyl)phthalate	NE	0.31 UJ	63 U	0.3 U	0.31 U	0.32 U	0.31 U	**0.12 J**	**0.061 J**	0.37 U
Butyl benzyl phthalate	NE	**0.046 J**	63 U	0.3 U	0.31 U	**0.021 J**	0.31 U	0.32 UJ	0.32 UJ	0.37 U
Total SVOCs	NE	**2.113**	**1218.7**	**1.004**	ND	**0.021**	**0.665**	**0.12**	**0.061**	**10.587**

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Restricted-Residential SCO	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010	SSGP-06 (3-3.5) 6/27/2013
Metals (mg/kg)										
Aluminum	NE	**13300**	**3770**	**11100**	**6550**	**14400**	**8870**	**12900**	**6090**	**7700**
Arsenic	16	**5.9 J**	**3 J**	**3.6 J**	**3 J**	**3.3 J**	**3.3 J**	**3.1 J**	**3 J**	**5.9**
Barium	400	**34.2 J**	**23.8 J**	**53.1 J**	**49.1 J**	**48.4**	**32 J**	**44.7 J**	**68.4 J**	**91**
Beryllium	72	**0.6 J**	**0.22 J**	**0.51 J**	**0.45 J**	**0.49 J**	**0.51 J**	**0.5 J**	**0.53 J**	0.45 U
Calcium	NE	**1350**	**1260**	**7560**	**1300**	**1520**	**879**	**4750**	**1340**	**28000**
Chromium	NE	**19.4 J**	**9.3 J**	**21.1 J**	**18.8 J**	**20 J**	**19.2 J**	**21.1 J**	**15.7 J**	**23 J**
Cobalt	NE	**9.5 J**	**2.2**	**4.9**	**5.8**	**6.1**	**4.3**	**6.3**	**7.1**	11 U
Copper	270	**21.1**	**5.6**	**24.3 J**	**25.6 J**	**10.7 J**	**14.3 J**	**14.4 J**	**23.8 J**	**63**
Iron	NE	**22300**	**8840**	**19500**	**16800**	**19800**	**22500**	**20200**	**23300**	**20000**
Lead	400	**16.5**	**3.8 J**	**14.3**	**5.2**	**9.3**	**27.1**	**8.7**	**5.3**	**160 J**
Magnesium	NE	**2950**	**1620**	**3990**	**2170**	**2770**	**1800**	**3650**	**2250**	**3600 J**
Manganese	2000	**259**	**231**	**160**	**246**	**433**	**155**	**296**	**469**	**610**
Mercury	0.81	0.072 U	0.054 U	0.052 U	0.051 U	0.055 U	**0.12**	0.057 U	0.058 U	**0.38**
Nickel	310	**16.4 J**	**8.6 J**	**14.8 J**	**12.1 J**	**14.7 J**	**11.4 J**	**13.2**	**11.8 J**	**31**
Potassium	NE	**910**	**701**	**1470**	**1490**	**836**	**720**	**830**	**1080**	1100 U
Silver	180	**0.22 J**	**0.15 J**	**0.25 J**	**0.2 J**	1.3 U	1.3 U	1.5 U	1.5 U	2.2 U
Vanadium	NE	**32 J**	**10 J**	**32.2 J**	**28.4 J**	**28.3**	**27.7 J**	**28 J**	**36.1 J**	**62**
Zinc	10000	**33.5**	**15.8**	**51.1**	**29.2**	**43.8**	**35.9**	**32.9**	**32.2**	**280**
Cyanides (mg/kg)										
Free Cyanide	NE	0.23 U	0.23 U	0.22 U	0.23 U	0.24 U	0.23 U	0.24 U	0.24 U	2.5 U

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Restricted-Residential SCO	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013	SSGP-09 (3.0-3.4) 6/25/2013
BTEX (mg/kg)										
Benzene	4.8	0.0011 UJ	0.0011 UJ	**0.0013 J**	**0.0011 J**	0.0013 UJ	**0.61 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Toluene	100	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**12 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Ethylbenzene	41	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**29 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
o-Xylene	100	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**11 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
m/p-Xylene	100	0.0022 UJ	0.0022 UJ	0.0024 UJ	0.0023 UJ	0.0026 UJ	**25 J**	0.0022 UJ	0.0025 UJ	0.0023 UJ
Total Xylene	100	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total BTEX	NE	ND	ND	**0.0013**	**0.0011**	ND	**77.61**	ND	ND	ND
Other VOCs (mg/kg)										
Acetone	100	0.011 UJ	0.011 UJ	**0.015 J**	**0.013 J**	0.013 UJ	0.65 UJ	0.011 UJ	0.013 UJ	0.012 UJ
Carbon disulfide	NE	0.0011 UJ	0.0011 UJ	**0.0015 J**	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
1,2-Dichloroethane	3.1	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Isopropylbenzene	NE	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**3.1 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Methylcyclohexane	NE	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Methylene chloride	100	**0.0014 J**	0.0011 UJ	**0.018 J**	**0.015 J**	0.003 UJ	0.13 UJ	0.0035 UJ	0.0052 UJ	0.0053 UJ
Styrene	NE	0.0011 UJ	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	**0.14 J**	0.0011 UJ	0.0013 UJ	0.0012 UJ
Tetrachloroethene (PCE)	19	**0.055 J**	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Trichloroethene (TCE)	21	**0.0022 J**	0.0011 UJ	0.0012 UJ	0.0011 UJ	0.0013 UJ	0.13 UJ	0.0011 UJ	0.0013 UJ	0.0012 UJ
Total VOCs	NE	**0.0586**	ND	**0.0358**	**0.0291**	ND	**80.85**	ND	ND	ND
PAHs (mg/kg)										
Acenaphthylene	100	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Anthracene	100	0.39 U	0.36 U	0.37 U	**0.5**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Benzo(a)anthracene	1	0.039 U	0.036 U	**0.85**	**1.3**	0.043 U	0.22 U	**0.075**	0.042 U	0.036 U
Benzo(b)fluoranthene	1	0.039 U	0.036 U	**1.1**	**1.5**	**0.055**	0.22 U	**0.079**	0.042 U	0.036 U
Benzo(k)fluoranthene	3.9	0.039 U	0.036 U	**0.4**	**0.5**	0.043 U	0.22 U	**0.038**	0.042 U	0.036 U
Benzo(g,h,i)perylene	100	0.39 U	0.36 U	**0.5**	**1.1**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Benzo(a)pyrene	1	0.039 U	0.036 U	**0.86**	**1.4**	0.043 U	0.22 U	**0.075**	0.042 U	0.036 U
Chrysene	3.9	0.39 U	0.36 U	**0.96**	**1.5**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Dibenz(a,h)anthracene	0.33	0.039 U	0.036 U	**0.058 J**	**0.18 J**	0.043 U	0.22 U	0.036 U	0.042 U	0.036 U
Fluoranthene	100	0.39 U	0.36 U	**1.9**	**3.1**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Indeno(1,2,3-cd)pyrene	0.5	0.039 U	0.036 U	**0.61 J**	**1.2 J**	0.043 U	0.22 U	**0.071**	0.042 U	0.036 U
2-Methylnaphthalene	NE	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	**8.1 J**	0.36 U	0.42 U	0.36 U
Naphthalene	100	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	**38 J**	0.36 U	0.42 U	0.36 U
Phenanthrene	100	0.39 U	0.36 U	**1.7**	**2.5**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Pyrene	100	0.39 U	0.36 U	**1.7**	**1.8**	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Total PAH	NE	ND	ND	**10.638**	**16.58**	**0.055**	**46.1**	**0.338**	ND	ND
Other SVOCs (mg/kg)										
Bis(2-ethylhexyl)phthalate	NE	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Butyl benzyl phthalate	NE	0.39 U	0.36 U	0.37 U	0.37 U	0.43 U	2.2 U	0.36 U	0.42 U	0.36 U
Total SVOCs	NE	ND	ND	**10.638**	**16.58**	**0.055**	**46.1**	**0.338**	ND	ND

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Restricted-Residential SCO	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013	SSGP-09 (3.0-3.4) 6/25/2013
Metals (mg/kg)										
Aluminum	NE	**3800**	**5600**	**7600**	**8100**	**4700**	**8400**	**6700**	**9100**	**12000**
Arsenic	16	1.1 U	**1.5**	**5.6**	**7.8**	**2.1**	**6.8**	**5.9**	**3.7**	**4**
Barium	400	43 U	**53**	**190**	**210**	47 U	**91**	**46**	**77**	**62**
Beryllium	72	0.43 U	0.41 U	0.34 U	0.41 U	0.47 U	0.44 U	0.39 U	0.42 U	**0.61**
Calcium	NE	1100 U	**1800**	**15000 J**	**29000 J**	**2200**	**5200**	**4300**	**15000**	**1900**
Chromium	NE	**11 J**	**15 J**	**19 J**	**18 J**	**15 J**	**26 J**	**20 J**	**18 J**	**20 J**
Cobalt	NE	11 U	10 U	**13**	10 U	12 U	11 U	**13**	10 U	**11**
Copper	270	**22**	**25**	**44**	**33**	**28**	**21**	**63**	**25**	**22**
Iron	NE	**12000**	**17000**	**26000**	**28000**	**12000**	**17000**	**18000**	**17000**	**23000**
Lead	400	**4.6 J**	**7.1 J**	**270 J**	**330 J**	**56 J**	**160 J**	**330 J**	**73 J**	**46 J**
Magnesium	NE	**1400 J**	**2500 J**	**2600 J**	**3500 J**	**6600 J**	**4600 J**	**16000 J**	**6300 J**	**2500 J**
Manganese	2000	**110**	**260**	**340**	**450**	**190**	**290**	**290**	**460**	**440**
Mercury	0.81	0.02 U	0.018 U	**0.31**	**0.28**	**0.033**	**0.07**	**0.087**	0.021 U	**0.04**
Nickel	310	8.7 U	**11**	**21**	**20**	**69**	**41**	**170**	**36**	**17**
Potassium	NE	1100 U	**1200**	**960**	**1400**	**1200**	**1200**	**1500**	**2100**	**1100**
Silver	180	2.2 U	2.1 U	1.7 U	2 U	2.3 U	2.2 U	1.9 U	2.1 U	1.7 U
Vanadium	NE	**24**	**26**	**21**	**24**	**16**	**22**	**23**	**22**	**33**
Zinc	10000	**23**	**31**	**230**	**170**	**49**	**80**	**76**	**49**	**38**
Cyanides (mg/kg)										
Free Cyanide	NE	2.5 U	2.3 U	2.4 U	2.4 U	2.7 U	2.9 U	**2.9**	2.6 U	2.4 U

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Restricted-Residential SCO	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010	SSGP-17 (10-12) 8/22/2011	SSGP-18 (10-12) 8/23/2011	SSSB-19 (7.5-8.5) 3/11/2016
BTEX (mg/kg)										
Benzene	4.8	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U
Toluene	100	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	**0.00047 J**	0.0061 U	0.0056 U	0.00087 U
Ethylbenzene	41	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	**0.0017 J**	0.0061 U	0.0056 U	0.00087 U
o-Xylene	100	0.0013 UJ	0.0011 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
m/p-Xylene	100	0.0025 UJ	0.0022 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
Total Xylene	100	NA	NA	0.0059 U	0.0067 U	0.0055 U	**0.013**	0.0061 U	0.0056 U	NA
Total BTEX	NE	ND	ND	ND	ND	ND	**0.01517**	ND	ND	ND
Other VOCs (mg/kg)										
Acetone	100	0.034 UJ	0.011 UJ	0.024 UJ	0.027 UJ	0.022 U	0.045 U	0.024 UJ	0.022 UJ	0.0043 U
Carbon disulfide	NE	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 UJ	0.011 UJ	0.0061 U	0.0056 U	0.00087 U
1,2-Dichloroethane	3.1	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U
Isopropylbenzene	NE	0.0013 UJ	0.0011 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
Methylcyclohexane	NE	0.0013 UJ	0.0011 UJ	NA	NA	NA	NA	NA	NA	0.00087 U
Methylene chloride	100	0.0029 UJ	0.0013 UJ	0.024 U	0.027 U	0.022 U	0.045 U	0.024 UJ	0.022 UJ	0.00087 U
Styrene	NE	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	**0.011**	0.0061 U	0.0056 U	0.00087 U
Tetrachloroethene (PCE)	19	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	**0.0011**
Trichloroethene (TCE)	21	0.0013 UJ	0.0011 UJ	0.0059 U	0.0067 U	0.0055 U	0.011 U	0.0061 U	0.0056 U	0.00087 U
Total VOCs	NE	ND	ND	ND	ND	ND	**0.02617**	ND	ND	**0.0011**
PAHs (mg/kg)										
Acenaphthylene	100	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	**0.016 J**	0.32 U	0.29 U	0.99 U
Anthracene	100	0.39 U	0.36 U	0.32 U	**0.015 J**	0.29 U	0.3 U	0.32 U	**0.016 J**	0.99 U
Benzo(a)anthracene	1	0.039 U	0.036 U	0.32 U	**0.059 J**	0.29 U	0.3 U	**0.031 J**	**0.042 J**	0.99 U
Benzo(b)fluoranthene	1	0.039 U	0.036 U	0.32 U	**0.035 J**	0.29 U	0.3 U	0.32 UJ	**0.057 J**	0.99 U
Benzo(k)fluoranthene	3.9	0.039 U	0.036 U	0.32 U	0.36 U	0.29 U	0.3 U	0.32 UJ	0.29 UJ	0.99 U
Benzo(g,h,i)perylene	100	0.39 U	0.36 U	0.32 U	**0.41**	0.29 U	0.3 U	0.32 UJ	**0.16 J**	0.99 U
Benzo(a)pyrene	1	0.039 U	0.036 U	0.32 U	**0.047 J**	0.29 U	0.3 U	0.32 UJ	**0.036 J**	0.99 U
Chrysene	3.9	0.39 U	0.36 U	0.32 U	**0.053 J**	0.29 U	0.3 U	**0.024 J**	**0.068 J**	0.99 U
Dibenz(a,h)anthracene	0.33	0.039 U	0.036 U	0.32 U	0.36 U	0.29 U	0.3 U	0.32 UJ	0.29 UJ	0.99 U
Fluoranthene	100	0.39 U	0.36 U	0.32 U	**0.073 J**	0.29 U	0.3 U	**0.04 J**	**0.05 J**	0.99 U
Indeno(1,2,3-cd)pyrene	0.5	0.039 U	0.036 U	0.32 U	**0.19 J**	0.29 U	0.3 U	0.32 UJ	**0.13 J**	0.99 U
2-Methylnaphthalene	NE	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	**0.27 J**	0.32 U	0.29 U	0.99 U
Naphthalene	100	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	**1.5**	0.32 U	0.29 U	0.99 U
Phenanthrene	100	0.39 U	0.36 U	0.32 U	0.36 U	0.29 U	0.3 U	0.32 U	**0.075 J**	0.99 U
Pyrene	100	0.39 U	0.36 U	0.32 UJ	**0.3 J**	0.29 UJ	0.3 UJ	**0.086 J**	**0.11 J**	0.99 U
Total PAH	NE	ND	ND	ND	**1.182**	ND	**1.786**	**0.181**	**0.744**	ND
Other SVOCs (mg/kg)										
Bis(2-ethylhexyl)phthalate	NE	0.39 U	0.36 U	0.32 UJ	0.36 UJ	0.29 UJ	0.3 UJ	0.32 UJ	0.29 UJ	0.99 U
Butyl benzyl phthalate	NE	0.39 U	0.36 U	0.32 UJ	0.36 UJ	0.29 UJ	0.3 UJ	0.32 UJ	0.29 UJ	0.99 U
Total SVOCs	NE	ND	ND	ND	**1.182**	ND	**1.786**	**0.181**	**0.744**	ND

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	Restricted-Residential SCO	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010	SSGP-17 (10-12) 8/22/2011	SSGP-18 (10-12) 8/23/2011	SSSB-19 (7.5-8.5) 3/11/2016
Metals (mg/kg)										
Aluminum	NE	**8900**	**13000**	**15000**	**10800**	**8120**	**3420**	NA	NA	**9200**
Arsenic	16	**1.8**	**1.1 J**	**5.6 J**	**3.4 J**	**3.3 J**	5.7 U	NA	NA	3.3 U
Barium	400	**49**	**89**	**56.7 J**	**60.4 J**	**46.5 J**	**23.2 J**	NA	NA	**48**
Beryllium	72	**0.46**	**0.39**	**0.49 J**	**0.54 J**	**0.43 J**	**0.24 J**	NA	NA	**0.64**
Calcium	NE	950 U	**2400**	**2920**	**1090**	**1190**	**690**	NA	NA	**12000**
Chromium	NE	**23 J**	**41 J**	**19.8 J**	**20.8 J**	**21.6 J**	**10.2 J**	NA	NA	**16**
Cobalt	NE	9.5 U	**11**	**7.5 J**	**7.9**	**7.3**	**3.1**	NA	NA	11 U
Copper	270	**23**	**11**	**10.6**	**17.2 J**	**19.9 J**	**11**	NA	NA	**21**
Iron	NE	**27000**	**28000**	**22300**	**20400**	**19700**	**11600**	NA	NA	**19000**
Lead	400	**7.6 J**	**4.4 J**	**10.4 J**	**5.1**	**5.7**	**3.3 J**	NA	NA	**23 J**
Magnesium	NE	**3800 J**	**10000 J**	**2870**	**3580**	**2880**	**1190**	NA	NA	**6100**
Manganese	2000	**680**	**310**	**706**	**228**	**343**	**131**	NA	NA	**500**
Mercury	0.81	0.02 U	0.018 U	0.054 U	0.064 U	0.054 U	0.053 U	NA	NA	**0.037**
Nickel	310	**14**	**24**	**12.9 J**	**20.3 J**	**14.1 J**	**7.7 J**	NA	NA	**17**
Potassium	NE	**1600**	**8500**	**914**	**1810**	**1600**	**500**	NA	NA	1100 U
Silver	180	1.9 U	1.7 U	**0.31 J**	**0.22 J**	1.3 U	1.4 U	NA	NA	2.2 U
Vanadium	NE	**36**	**83**	**26.2 J**	**27.7 J**	**33.8 J**	**18.3 J**	NA	NA	**40**
Zinc	10000	**48**	**24**	**43.4**	**40.8**	**31.5**	**16.2**	NA	NA	**39**
Cyanides (mg/kg)										
Free Cyanide	NE	2.6 U	2.4 U	0.24 U	0.27 U	0.22 U	0.22 U	NA	NA	2.5 U

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Restricted-Residential SCO	Duplicate of SSSB-19 (7.5-8.5) 3/11/2016	SSSB-19 (13.5-15) 3/11/2016	SSSB-19 (33-34) 3/11/2016	SSSB-20 (23.5-24) 3/10/2016	SSSB-20 (33-34) 3/10/2016	SSSB-21 (21.5-22) 3/9/2016	SSSB-22 (20-23) 3/10/2016	SSSB-23 (32.5-33.5) 3/11/2016
BTEX (mg/kg)									
Benzene	4.8	**0.0024**	0.00075 U	**0.016**	**0.0025**	**0.096**	**0.002**	0.0008 U	**0.019**
Toluene	100	0.001 U	0.00075 U	**0.0016**	**0.0013**	**0.076**	0.0007 U	0.0008 UJ	**0.0041**
Ethylbenzene	41	0.001 U	0.00075 U	**0.19**	0.00077 U	**0.48**	0.0007 U	0.0008 U	**0.087**
o-Xylene	100	0.001 U	0.00075 U	**0.017**	0.00077 U	**0.16**	0.0007 U	0.0008 U	**0.012**
m/p-Xylene	100	0.001 U	0.00075 U	**0.01**	0.00077 U	**0.33**	0.0007 U	0.0008 U	**0.015**
Total Xylene	100	NA	NA	NA	NA	NA	NA	NA	NA
Total BTEX	NE	**0.0024**	ND	**0.2346**	**0.0038**	**1.142**	**0.002**	ND	**0.1371**
Other VOCs (mg/kg)									
Acetone	100	0.005 U	0.056 U	0.0035 U	0.015 U	0.19 U	0.0068 U	0.004 U	0.005 U
Carbon disulfide	NE	0.001 U	0.00075 U	0.00071 U	**0.0014**	0.038 U	0.0007 U	**0.00081**	0.00076 U
1,2-Dichloroethane	3.1	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Isopropylbenzene	NE	0.001 U	0.00075 U	**0.019**	0.00077 U	**0.058**	0.0007 U	0.0008 U	**0.01**
Methylcyclohexane	NE	0.001 U	0.00075 U	**0.0012**	**0.00095**	0.038 U	0.0007 U	0.0008 U	**0.0024**
Methylene chloride	100	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Styrene	NE	0.001 U	0.00075 U	0.00071 U	**0.00088**	0.038 U	**0.001**	0.0008 U	0.00076 U
Tetrachloroethene (PCE)	19	**0.001**	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Trichloroethene (TCE)	21	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U	0.0008 U	0.00076 U
Total VOCs	NE	**0.0034**	ND	**0.2548**	**0.00703**	**1.2**	**0.003**	**0.00081**	**0.1495**
PAHs (mg/kg)									
Acenaphthylene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Anthracene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(a)anthracene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(b)fluoranthene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(k)fluoranthene	3.9	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(g,h,i)perylene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Benzo(a)pyrene	1	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Chrysene	3.9	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Dibenz(a,h)anthracene	0.33	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Fluoranthene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Indeno(1,2,3-cd)pyrene	0.5	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
2-Methylnaphthalene	NE	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Naphthalene	100	0.22 U	0.19 U	**0.69**	0.19 U	**1.2**	0.19 U	0.21 U	**0.42**
Phenanthrene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Pyrene	100	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Total PAH	NE	ND	ND	**0.69**	ND	**1.2**	ND	ND	**0.42**
Other SVOCs (mg/kg)									
Bis(2-ethylhexyl)phthalate	NE	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Butyl benzyl phthalate	NE	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.21 U	0.19 U
Total SVOCs	NE	ND	ND	**0.69**	ND	**1.2**	ND	ND	**0.42**

Table 6. Summary of Soil Impacts Above Site-Specific Action Levels
Former Skillman Street Holder
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	Restricted-Residential SCO	Duplicate of SSSB-19 (7.5-8.5) 3/11/2016	SSSB-19 (13.5-15) 3/11/2016	SSSB-19 (33-34) 3/11/2016	SSSB-20 (23.5-24) 3/10/2016	SSSB-20 (33-34) 3/10/2016	SSSB-21 (21.5-22) 3/9/2016	SSSB-22 (20-23) 3/10/2016	SSSB-23 (32.5-33.5) 3/11/2016
Metals (mg/kg)									
Aluminum	NE	**6500**	**7000**	**5900**	**6700**	**5900**	**9800**	**6200**	**6700**
Arsenic	16	3.4 U	3.3 U	3.4 U	3 U	3.4 U	2.8 U	3.7 U	3.3 U
Barium	400	45 U	**48**	**52**	40 U	**52**	**46**	**54**	**58**
Beryllium	72	**0.51**	**0.74**	**0.7**	**0.52**	**0.56**	**0.84**	0.49 U	**0.73**
Calcium	NE	**7300**	1100 U	**1400**	**2200**	**5200**	**3300**	**2700**	**2600**
Chromium	NE	**14**	**32**	**18**	**21**	**19**	**24**	**11**	**22**
Cobalt	NE	11 U	11 U	11 U	10 U	11 U	**9.7**	12 U	11 U
Copper	270	**13**	**24**	**21**	**14**	**21**	**21**	**19**	**26**
Iron	NE	**15000**	**25000**	**20000**	**18000**	**22000**	**25000**	**18000**	**25000**
Lead	400	**11 J**	**7.1**	**6.9**	**4.3**	**6.1**	**5.3**	**3**	**7.2**
Magnesium	NE	**4500**	**2400**	**2400**	**4200**	**2800**	**6200**	**1600**	**3200**
Manganese	2000	**390**	**240**	**330**	**510**	**410**	**360**	**240**	**340**
Mercury	0.81	0.02 U	0.019 U	0.019 U	0.017 U	0.018 U	0.019 U	0.019 U	0.018 U
Nickel	310	**12**	**15**	**13**	**13**	**13**	**16**	9.8 U	**16**
Potassium	NE	**1100**	**1800**	**1600**	**1200**	**1600**	**3300**	**1900**	**2300**
Silver	180	2.2 U	2.2 U	2.3 U	2 U	2.3 U	1.9 U	2.5 U	2.2 U
Vanadium	NE	**25**	**38**	**29**	**34**	**30**	**41**	**28**	**36**
Zinc	10000	**30**	**36**	**33**	**27**	**32**	**30**	**25**	**39**
Cyanides (mg/kg)									
Free Cyanide	NE	2.6 U	2.4 U	2.2 U	2.4 U	2.2 U	1.8 U	2.4 U	2.1 U

Notes:

mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, and Total SVOCs are calculated using detects only.
Total PAHs are calculated using the following list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, 2-Methylnaphthalene, Naphthalene, Phenanthrene, and Pyrene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

ND = Not Detected
NE = Not Established
NA = Not Analyzed
NYSDEC = New York State Department of Environmental Conservation

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Yellow shading and bolding indicates that the detected result value exceeds the Restricted-Residential SCO

Validation Qualifiers:
J = The result is an estimated value.
R = The result is rejected.
U = The result was not detected above the reporting limit.
UJ = The results were not detected at or above the reporting limit shown and the reporting limit is estimated.

Table 7. Analytical Groundwater Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	NYS AWQS	SSGW-01 (13-23) 6/27/2013	Duplicate of SSGW-01 (13-23) 6/27/2013	SSGW-02 (11.5-21.5) 6/28/2013	SSGW-03 (15-25) 6/26/2013	SSGW-05 (8-18) 8/9/2010	SSGW-06 (11-16) 8/25/2010	SSGW-19 (14-24) 3/11/2016	SSGW-23 (15-25) 3/11/2016	Duplicate of SSGW-23 (15-25) 3/11/2016	SSMW-02 (11-21) 5/31/2011	SSMW-03 (12-22) 5/31/2011	SSMW-04 (10-20) 6/1/2011
BTEX (ug/L)													
Benzene	1	**4300**	**5600**	**240**	**13**	5 U	100 U	1 U	**1.7**	**1.7**	**100 J**	**0.76 J**	5 U
Toluene	5	**16000**	**20000**	**79**	1 U	5 U	**1100**	1 U	1 U	1 U	**260**	5 U	5 U
Ethylbenzene	5	**9500**	**12000**	**32**	1 U	5 U	**930**	1 U	**1.8**	**1.6**	**250**	5 U	5 U
o-Xylene	5	**4000**	**4900**	**150**	1 U	NA	NA	1 U	1 U	**1**	NA	NA	NA
m/p-Xylene	5	**7700**	**9400**	**100**	2 U	NA	NA	1 U	1 U	1.4 U	NA	NA	NA
Total Xylene	5	NA	NA	NA	NA	5 U	**3900**	NA	NA	NA	**800**	**3.6 J**	5 U
Total BTEX	NE	**41500**	**51900**	**601**	**13**	ND	**5930**	ND	**3.5**	**4.3**	**1410**	**4.36**	ND
Other VOCs (ug/L)													
Acetone	50*	250 U	250 U	50 U	5 U	10 UJ	200 U	5 U	5 U	5 U	**850**	10 U	10 UJ
Bromodichloromethane	50*	50 U	50 U	10 U	1 U	5 U	100 U	**4**	**2.6**	**2.6**	250 U	5 U	5 U
Carbon disulfide	60*	50 U	50 U	10 U	1 U	5 U	100 U	1 U	1 U	1 U	250 U	5 U	5 U
Chloroform (Trichloromethane)	7	50 U	50 U	10 U	1 U	5 U	100 U	**15**	**11**	**11**	250 U	5 U	5 U
1,1-Dichloroethane	5	50 U	50 U	10 U	1 U	5 U	100 U	1 U	1 U	1 U	250 U	5 U	5 U
1,2-Dichloroethane	0.6	50 U	50 U	10 U	1 U	5 U	100 U	1 U	1 U	1 U	250 U	5 U	5 U
cis-1,2-Dichloroethene	5	50 U	50 U	**1900**	**9.2**	5 U	100 U	1 U	1 U	1 U	**8000**	**3.6 J**	**1.4 J**
trans-1,2-Dichloroethene	5	50 U	50 U	10 U	1 U	5 U	100 U	1 U	1 U	1 U	**39 J**	5 U	5 U
Isopropylbenzene	5	**350**	**420**	**64**	1 U			1 U	1 U	1 U	NA	NA	NA
Styrene	5	**70 J**	**82**	10 U	1 U	5 U	**1800**	1 U	1 U	1 U	**360**	5 U	5 U
Tetrachloroethene (PCE)	5	50 U	50 U	**230**	1 U	5 U	100 U	**1.8**	**1**	**1.1**	**9400**	5 U	**12**
1,1,1-Trichloroethane (TCA)	5	50 U	50 U	10 U	1 U	5 U	100 U	1 U	1 U	1 U	250 U	5 U	5 U
Trichloroethene (TCE)	5	50 U	50 U	**140**	1 U	5 U	100 U	1 U	1 U	1 U	**1900**	5 U	**0.82 J**
Vinyl chloride	2	50 U	50 U	**200**	1 U	5 U	100 U	1 U	1 U	1 U	**380**	**1.1 J**	5 U
Total VOCs	NE	**41920**	**52402**	**3135**	**22.2**	0	**7730**	**20.8**	**18.1**	**19**	**22339**	**9.06**	**14.22**
PAHs (ug/L)													
2-Methylnaphthalene	NE	520 U	**200**	10 U	11 U	4.3 U	**100 J**	11 U	11 U	11 U	**10 J**	4 U	4 U
Naphthalene	10*	**5600 J**	**3300 J**	**62**	11 U	4.3 U	**3300**	11 U	11 U	11 U	**490**	**5.6**	4 U
Total PAH	NE	**5600**	**3500**	**62**	ND	ND	**3400**	ND	ND	ND	**500**	**5.6**	ND
Other SVOCs (ug/L)													
Benzyl alcohol	NE	NA	NA	NA	NA	**0.46 J**	220 U	NA	NA	NA	40 U	4 U	**0.5 J**
Bis(2-ethylhexyl)phthalate	5	520 U	200 U	10 U	11 U	4.3 UJ	220 U	2.2 U	**5.1**	**5.8**	40 UJ	**0.62 J**	4 U
Di-n-butyl phthalate	50	520 U	200 U	10 U	11 U	**0.54 J**	220 U	11 U	11 U	11 U	40 U	4 U	**0.35 J**
2-Methylphenol (o-Cresol)	1	520 U	200 U	10 U	11 U	4.3 U	220 U	11 U	11 U	11 U	40 U	4 U	4 U
Phenol	1	520 U	200 U	10 U	11 U	4.3 U	220 U	11 U	11 U	11 U	40 U	4 U	4 U
Total SVOCs	NE	**5600**	**3500**	**62**	ND	**1**	**3400**	ND	**5.1**	**5.8**	**500**	**6.22**	**0.85**
Total Metals (ug/L)													
Aluminum	NE	**2900 J**	**10000 J**	**27000**	**130000**	**590**	250 U	**180000**	**6500 J**	**3900 J**	**43.2 J**	**161 J**	**6510**
Antimony	3	10 U	10 U	10 U	40 U	15 U	15 U	60 UJ	20 UJ	20 UJ	15 U	15 U	**5.1 J**
Arsenic	25	**9.2**	**13**	**7.8**	20 U	15 U	**12.1 J**	**47**	15 U	15 U	15 U	15 U	15 U
Barium	1000	200 U	**200**	**400**	**860**	**96.2**	**249**	**1800**	200 U	200 U	**232**	**113**	**110**
Beryllium	3*	2 U	2 U	2 U	8 U	5 U	5 U	**17**	2 U	2 U	5 U	5 U	5 U

Table 7. Analytical Groundwater Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name		SSGW-01	Duplicate of SSGW-01	SSGW-02	SSGW-03	SSGW-05	SSGW-06	SSGW-19	SSGW-23	Duplicate of SSGW-23	SSMW-02	SSMW-03	SSMW-04
Sample Depth (feet)		(13-23)	(13-23)	(11.5-21.5)	(15-25)	(8-18)	(11-16)	(14-24)	(15-25)	(15-25)	(11-21)	(12-22)	(10-20)
Sample Date	NYS AWQS	6/27/2013	6/27/2013	6/28/2013	6/26/2013	8/9/2010	8/25/2010	3/11/2016	3/11/2016	3/11/2016	5/31/2011	5/31/2011	6/1/2011
Calcium	NE	81000	86000	83000	220000	108000	99400	75000	84000	75000	95200	73100	354000
Chromium	50	10 UJ	21 J	68	380	3.1 J	1.6 J	430	15	10	0.9 J	5 U	17.5
Cobalt	NE	50 U	50 U	50 U	200 U	1.7 J	3.9 J	180	50 U	50 U	5.3	5 U	6.7
Copper	200	25 U	39	160	390	2.1 J	10 U	870	25 U	25 U	6.4 J	10 U	24.3
Iron	300	20000	26000	50000	410000	10100	6840	420000	18000 J	13000 J	26400	3720	15100
Lead	25	83 J	280 J	75	170	15 U	15 U	180	10 U	10 U	15 U	15 U	15 U
Magnesium	35000*	11000 J	18000 J	30000	150000	10100	21100	71000	20000	18000	24200	19100	188000
Manganese	300	690 J	1300 J	2700	30000	2780	5830	7300	2000	1700	7070	965	1590
Mercury	0.7	0.2 U	0.3	0.2 U	0.2 U	0.4 U	0.4 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Nickel	100	40 UJ	83 J	57	280	2 J	2.6 J	360	49	41	3.3 J	3.1 J	13.2
Potassium	NE	17000	18000	20000	61000	6180	21400	49000	14000	13000	22400	16300	33400
Selenium	10	10 U	10 U	10 U	40 U	38 U	38 U	60 U	20 U	20 U	38 U	38 U	20.3 J
Silver	50	10 U	10 U	10 U	40 U	0.49 J	5 U	30 UJ	10 UJ	10 UJ	5 U	5 U	5 U
Sodium	20000	100000	110000	83000	140000	59800	99900	56000	82000	73000	114000	197000	87500
Thallium	0.5*	10 U	10 U	10 U	40 U	15 U	15 U	60 U	20 U	20 U	15 U	15 U	4 J
Vanadium	NE	50 U	50 U	79	480	3.5 J	4.3 J	650	50 U	50 U	3.5 J	1.9 J	22.5
Zinc	2000*	33 J	130 J	230	940	25 U	25 U	810	41	30 U	25 U	25 U	23.7 J
Cyanides (ug/L)													
Total Cyanide	200	240 J	200 J	330 J	74 J	10 U	108	240	29	29	26.4	10 U	4.9 J

Table 7. Analytical Groundwater Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name / Sample Depth (feet) / Sample Date	NYS AWQS	SSMW-05 (11-21) 6/1/2011	Duplicate of SSMW-05 (11-21) 6/1/2011	SSMW-06 (25-30) 5/31/2011	SSMW-07 (7-17) 9/9/2011	SSMW-08 (7-17) 9/9/2011
BTEX (ug/L)						
Benzene	1	5 U	5 U	**410**	5 U	5 U
Toluene	5	5 U	5 U	**600**	5 U	5 U
Ethylbenzene	5	5 U	5 U	**720**	5 U	5 U
o-Xylene	5	NA	NA	NA	NA	NA
m/p-Xylene	5	NA	NA	NA	NA	NA
Total Xylene	5	5 U	5 U	**1700**	5 U	5 U
Total BTEX	NE	ND	ND	**3430**	ND	ND
Other VOCs (ug/L)						
Acetone	50*	10 UJ	10 U	100 UJ	10 U	**9.7 J**
Bromodichloromethane	50*	5 U	5 U	50 U	5 U	5 U
Carbon disulfide	60*	5 U	5 U	50 U	5 U	**1.4 J**
Chloroform (Trichloromethane)	7	5 U	5 U	50 U	5 U	5 U
1,1-Dichloroethane	5	5 U	5 U	50 U	5 U	**3.4 J**
1,2-Dichloroethane	0.6	**4.3 J**	**4.1 J**	50 U	5 U	5 U
cis-1,2-Dichloroethene	5	5 U	5 U	**600**	5 U	5 U
trans-1,2-Dichloroethene	5	5 U	5 U	50 U	5 U	5 U
Isopropylbenzene	5	NA	NA	NA	NA	NA
Styrene	5	5 U	5 U	**92**	5 U	5 U
Tetrachloroethene (PCE)	5	**5.6**	5 U	50 U	**0.92 J**	5 U
1,1,1-Trichloroethane (TCA)	5	5 U	5 U	50 U	5 U	**2.9 J**
Trichloroethene (TCE)	5	5 U	5 U	50 U	**1.2 J**	5 U
Vinyl chloride	2	5 U	5 U	**290**	5 U	5 U
Total VOCs	NE	**9.9**	**4.1**	**4412**	**2.12**	**17.4**
PAHs (ug/L)						
2-Methylnaphthalene	NE	4.2 U	4 U	**14 J**	4 U	4 U
Naphthalene	10*	4.2 U	4 U	**1200**	4 U	4 U
Total PAH	NE	ND	ND	**1214**	ND	ND
Other SVOCs (ug/L)						
Benzyl alcohol	NE	4.2 U	4 U	80 U	4 U	4 U
Bis(2-ethylhexyl)phthalate	5	**0.59 J**	**0.6 J**	80 UJ	**0.62 J**	4 U
Di-n-butyl phthalate	50	**0.52 J**	**0.46 J**	80 U	4 U	4 U
2-Methylphenol (o-Cresol)	1	4.2 U	4 U	**21 J**	4 U	4 U
Phenol	1	4.2 U	4 U	80 U	4 U	**1.4 J**
Total SVOCs	NE	**1.11**	**1.06**	**1235**	**0.62**	**1.4**
Total Metals (ug/L)						
Aluminum	NE	**10.4 J**	250 U	**19 J**	NA	NA
Antimony	3	15 U	15 U	15 U	NA	NA
Arsenic	25	15 U	15 U	15 U	NA	NA
Barium	1000	**127**	**124**	**133**	NA	NA
Beryllium	3*	5 U	5 U	5 U	NA	NA

Table 7. Analytical Groundwater Summary
Former Skillman Street Holder Station
Brooklyn, New York

Sample Name Sample Depth (feet) Sample Date	NYS AWQS	SSMW-05 (11-21) 6/1/2011	Duplicate of SSMW-05 (11-21) 6/1/2011	SSMW-06 (25-30) 5/31/2011	SSMW-07 (7-17) 9/9/2011	SSMW-08 (7-17) 9/9/2011
Calcium	NE	**137000**	**133000**	**59700**	NA	NA
Chromium	50	**0.84 J**	**0.65 J**	5 U	NA	NA
Cobalt	NE	5 U	5 U	**4.4 J**	NA	NA
Copper	200	10 U	10 U	10 U	NA	NA
Iron	300	125 U	125 U	**214**	NA	NA
Lead	25	15 U	15 U	15 U	NA	NA
Magnesium	35000*	**31400**	**30500**	**18700**	NA	NA
Manganese	300	**7440**	**7540**	**3460**	NA	NA
Mercury	0.7	0.2 U	0.2 U	0.2 U	NA	NA
Nickel	100	**16.8**	**16.1**	**2.9 J**	NA	NA
Potassium	NE	**5870**	**5680**	**4580**	NA	NA
Selenium	10	38 U	38 U	38 U	NA	NA
Silver	50	5 U	5 U	5 U	NA	NA
Sodium	20000	**293000**	**276000**	**109000**	NA	NA
Thallium	0.5*	15 U	15 U	15 U	NA	NA
Vanadium	NE	**4 J**	5 U	**2.6 J**	NA	NA
Zinc	2000*	25 U	25 U	25 U	NA	NA
Cyanides (ug/L)						
Total Cyanide	200	**3.7 J**	**7.5 J**	**101**	NA	NA

Notes:

ug/L = micrograms per liter or parts per billion (ppb)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semivolatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, and Total SVOCs are calculated using detects only.
Total PAHs are calculated using the following list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, 2-Methylnaphthalene, Naphthalene, Phenanthrene, and Pyrene

NYS AWQS = New York State Ambient Water Quality Standards and Guidance Values for GA groundwater
* indicates the value is a guidance value and not a standard

ND = Not Detected
NE = Not Established
NA = Not Analyzed
NYSDEC = New York State Department of Environmental Conservation

NYS AWQS - New York State Ambient Water Quality Standards and Guidance Values for GA groundwater
* indicates the value is a guidance value and not a standard

Bolding indicates a detected concentration
Gray shading indicates that the detected result value exceeds NYS AWQS

Validation Qualifiers:
J = The result is an estimated value.
U = The result was not detected above the reporting limit.
UJ = The results were not detected at or above the reporting limit shown and the reporting limit is estimated.

Table 8. Analytical Air Results
Former Skillman Street Holder Station
Brooklyn, New York

	Soil Vapor			EPA BASE	NYSDOH	Indoor Air			EPA BASE	Outdoor Air
Sample Name:	SSSV-01	Duplicate of SSSV-01	SSSV-02	Indoor Air Concentrations	Air Guidance	SSIA-01	Duplicate of SSIA-01	SSIA-02	Outdoor Air Concentrations	SSOA-01
Sample Date:	3/25/2011	3/25/2011	3/24/2011	90th Percentile[1]	Value	3/25/2011	3/25/2011	3/25/2011	90th Percentile[1]	3/25/2011
Possibly MGP-Related VOCs (ug/m ^{3})										
Benzene	**9.4**	**12**	**35**	9.4	NE	**1.3**	**1.4**	**0.71**	6.6	**0.72**
Toluene	**60**	**59**	**96**	43	NE	**6.3 J**	**2.5 J**	**1.5**	33.7	**1.1**
Ethylbenzene	**5.5 J**	**7.8 J**	**12 J**	5.7	NE	**1.2 J**	**0.7 J**	**0.5**	3.5	**0.27 J**
m,p-Xylene	**17 J**	**24 J**	**40**	NE	NE	**3.3 J**	**2.3 J**	**1.7**	NE	**0.78**
o-Xylene	**5.2 J**	**7.4 J**	**13 J**	7.9	NE	**1.3 J**	**0.91 J**	**0.64**	4.6	**0.35**
Naphthalene	**2.4 J**	**2.6 J**	48 UJ	5.1	NE	**1.2 J**	1 UJ	1 UJ	4.9	1 UJ
Indane	**2.2 J**	**2.3 J**	18 UJ	NE	NE	0.39 UJ	0.39 UJ	0.39 UJ	NE	0.39 UJ
Indene	3.8 UJ	0.76 UJ	35 UJ	NE	NE	0.76 UJ	0.76 UJ	0.76 U	NE	0.76 UJ
1,2,4-Trimethylbenzene	**7.8**	**10**	**12 J**	9.5	NE	**1.5 J**	**0.71 J**	**1.2**	5.8	**0.39 J**
Nonane	**4.8 J**	**5.7**	**8.4 J**	7.8	NE	**3.6 J**	**1.7 J**	**1.8**	2.8	**0.31 J**
n-Decane	**6.2 J**	**7.9**	**16 J**	17.5	NE	**6.5 J**	**1.2 J**	**1.8 J**	7.6	**1.4 J**
n-Undecane	**8.8 J**	**10 J**	120 UJ	22.6	NE	**2.4 J**	**0.46 J**	**0.49 J**	14.8	**0.4 J**
n-Dodecane	**1.9 J**	**2 J**	130 UJ	15.9	NE	**1.2 J**	2.8 UJ	2.8 UJ	10.4	2.8 UJ
Not MGP-Related VOCs (ug/m ^{3})										
Acetaldehyde	36 UJ	**15 J**	330 UJ	NE	NE	**14 J**	**17 J**	**12 J**	NE	**7.2 J**
Acetone	**66 J**	**70 J**	220 U	98.9	NE	**20 J**	**18 J**	**13 J**	43.7	**8.3 J**
Acrolein (propenal)	3.7 U	**0.79**	33 U	NE	NE	**1.1 J**	**1.5 J**	**0.95**	NE	**0.69 J**
Allyl chloride (Chloropropene,3-)	1.3 U	0.25 U	11 U	NE	NE	0.25 U	0.25 U	0.25 U	NE	0.25 U
1-Benzothiophene	5.2 UJ	1 UJ	47 UJ	NE	NE	1 UJ	1 UJ	1 UJ	NE	1 UJ
Bromodichloromethane	2.7 U	0.54 U	24 U	NE	NE	0.54 U	0.54 U	0.54 U	NE	0.54 U
Bromoform	4.1 U	0.83 U	38 U	NE	NE	0.83 U	0.83 U	0.83 U	NE	0.83 U
Bromomethane	1.6 U	**0.27 J**	14 U	1.7	NE	0.31 U	0.31 U	0.31 U	1.6	0.31 U
1,3-Butadiene	**0.4 J**	**0.34 J**	16 U	3	NE	0.35 U	0.35 U	0.35 U	3.4	**0.088 J**
Butane	**1.7 J**	**1.3**	17 U	NE	NE	**17**	**16**	**4.9**	NE	**2.3**
2-Butanone	**8**	**10**	54 U	12	NE	**2.7**	**2**	**1.7**	11.3	**1.1 J**
t-Butyl alcohol (Tertiary Butyl Alcohol)	12 U	**1.1 J**	110 U	NE	NE	**0.9 J**	2.4 U	2.4 U	NE	2.4 U
Carbon disulfide	**11**	**9.1**	**15 J**	4.2	NE	0.62 U	0.62 U	0.62 U	3.7	0.62 U
Carbon tetrachloride	2.5 U	**0.35 J**	23 U	1.3	NE	**0.61**	**0.72**	**0.57**	0.7	**0.69**
Chlorobenzene	1.8 U	0.37 U	17 U	0.9	NE	0.37 U	0.37 U	0.37 U	0.8	0.37 U
Chloroethane	1.1 U	0.21 U	9.6 U	1.1	NE	0.21 U	0.21 U	0.21 U	1.2	0.21 U
Chloroform	**0.39 J**	**0.34 J**	**96**	1.1	NE	**0.21 J**	**0.22 J**	**0.17 J**	0.6	**0.14 J**
Chloromethane	2.1 U	**0.14 J**	19 U	3.7	NE	**1.5**	**1.5**	**1.4**	3.7	**1.4**
2-Chlorotoluene	4.1 U	0.83 U	38 U	NE	NE	**0.3 J**	**0.46 J**	**0.23 J**	NE	0.83 U
Cryofluorane (Freon-114)	2.8 U	0.56 U	25 U	NE	NE	0.56 U	**0.12 J**	**0.2 J**	NE	0.56 U
Cyclohexane	3.4 U	0.69 U	31 U	NE	NE	**1.5**	**1.1**	**0.4 J**	NE	0.69 U
Dibromochloromethane	3.4 U	0.68 U	31 U	NE	NE	0.68 U	0.68 U	0.68 U	NE	0.68 U
1,2-Dibromoethane	3.1 U	0.61 U	28 U	1.5	NE	0.61 U	0.61 U	0.61 U	1.6	0.61 U
1,2-Dichlorobenzene	2.4 U	**0.2 J**	22 U	1.2	NE	0.48 U	**0.26 J**	0.48 U	1.2	0.48 U
1,3-Dichlorobenzene	2.4 U	**0.86**	22 U	2.4	NE	0.48 U	**0.23 J**	0.48 U	2.2	0.48 U
1,4-Dichlorobenzene	2.4 U	0.48 U	22 U	5.5	NE	**0.16 J**	**0.35 J**	0.48 U	1.2	0.48 U
Dichlorodifluoromethane	**4.2**	**3.1**	18 U	16.5	NE	**3**	**2.9**	**3**	8.1	**3.1**

Table 8. Analytical Air Results
Former Skillman Street Holder Station
Brooklyn, New York

Validated

	Soil Vapor			EPA BASE	NYSDOH	Indoor Air			EPA BASE	Outdoor Air
		Duplicate of		Indoor Air	Air		Duplicate of		Outdoor Air	
Sample Name:	SSSV-01	SSSV-01	SSSV-02	Concentrations	Guidance	SSIA-01	SSIA-01	SSIA-02	Concentrations	SSOA-01
Sample Date:	3/25/2011	3/25/2011	3/24/2011	90th Percentile[1]	Value	3/25/2011	3/25/2011	3/25/2011	90th Percentile[1]	3/25/2011
1,1-Dichloroethane	1.6 U	0.32 U	15 U	0.7	NE	0.32 U	0.32 U	0.32 U	0.6	0.32 U
1,2-Dichloroethane	1.6 U	**0.4**	15 U	0.9	NE	**0.17 J**	**0.21 J**	**0.096 J**	0.8	**0.11 J**
cis-1,2-Dichloroethene	1.6 U	0.32 U	**1500**	1.9	NE	0.32 U	0.32 U	0.32 U	1.8	0.32 U
trans-1,2-Dichloroethene	1.6 U	0.32 U	**68**	NE	NE	0.32 U	0.32 U	0.32 U	NE	0.32 U
1,1-Dichloroethene	1.6 U	0.32 U	14 U	1.4	NE	0.32 U	0.32 U	0.32 U	1.4	0.32 U
1,2-Dichloropropane	1.8 U	0.37 U	17 U	1.6	NE	0.37 U	0.37 U	0.37 U	1.6	0.37 U
cis-1,3-Dichloropropene	1.8 U	0.36 U	17 U	2.3	NE	0.36 U	0.36 U	0.36 U	2.2	0.36 U
trans-1,3-Dichloropropene	1.8 U	0.36 U	17 U	1.3	NE	0.36 U	0.36 U	0.36 U	1.4	0.36 U
1,4-Dioxane	3.6 U	0.72 U	33 U	NE	NE	0.72 U	0.72 U	0.72 U	NE	0.72 U
Ethanol	**49 J**	**63 J**	**120 J**	210	NE	**450 J**	**420 J**	**370 J**	57	**35 J**
2-Ethylthiophene	1.8 UJ	0.37 UJ	17 UJ	NE	NE	0.37 UJ	0.37 UJ	0.37 UJ	NE	0.37 UJ
p-Ethyltoluene	**2.6 J**	**2.8**	36 U	3.6	NE	**0.65 J**	**0.56 J**	**0.49 J**	3	0.79 U
n-Heptane	**3 J**	**3.3**	37 U	NE	NE	**1.2**	**1.1**	**0.41 J**	NE	**0.3 J**
Hexachlorobutadiene	21 U	4.3 U	190 U	6.8	NE	4.3 U	**0.61 J**	4.3 U	6.4	4.3 U
n-Hexane	**3 J**	**3.1**	32 U	10.2	NE	**9.8 J**	**2.3 J**	**0.94**	6.4	**0.89**
2-Hexanone	**0.99 J**	**1.1**	37 U	NE	NE	**0.28 J**	**0.25 J**	**0.22 J**	NE	0.82 U
Methyl tert-butyl ether	7.2 U	1.4 U	66 U	11.5	NE	1.4 U	1.4 U	1.4 U	6.2	1.4 U
4-Methyl-2-pentanone	**2.2 J**	**3.3**	37 U	6	NE	0.82 U	0.82 U	0.82 U	1.9	0.82 U
Methylene chloride	3.5 U	0.69 U	32 U	10	60	**5.9 J**	0.69 U	**2.2**	6.1	0.69 U
1-Methylnaphthalene	R	R	R	NE	NE	R	R	R	NE	R
2-Methylnaphthalene	R	R	R	NE	NE	R	R	R	NE	R
2-Methylthiophene	1.6 UJ	0.32 UJ	15 UJ	NE	NE	0.32 UJ	0.32 UJ	0.32 UJ	NE	0.32 UJ
3-Methylthiophene	1.6 UJ	0.32 UJ	15 UJ	NE	NE	0.32 UJ	0.32 UJ	0.32 UJ	NE	0.32 UJ
n-Octane	**7**	**8.3**	34 U	4.5	NE	**0.63 J**	**0.71 J**	**0.39 J**	1.6	**0.16 J**
Pentane	**2.8 J**	**3.3**	54 U	NE	NE	**13 J**	**4.3 J**	**1.8**	NE	**1 J**
2-Propanol (Isopropyl Alcohol)	**9.3 J**	**8**	89 U	250	NE	**14**	**13**	**14**	16.5	**2.6**
Styrene	**0.81 J**	**1.1**	15 U	1.9	NE	**0.25 J**	**0.11 J**	0.34 U	1.3	0.34 U
1,1,2,2-Tetrachloroethane	2.7 U	0.55 U	25 U	NE	NE	0.55 U	0.55 U	0.55 U	NE	0.55 U
Tetrachloroethene	**230**	**200**	**12000**	15.9	100	**0.66**	**0.57**	**0.29 J**	6.5	**0.29 J**
1,2,4,5-Tetramethylbenzene	2.2 UJ	**0.92 J**	20 UJ	NE	NE	0.44 UJ	0.44 UJ	0.44 UJ	NE	0.44 UJ
Thiophene	1.4 UJ	0.28 UJ	13 UJ	NE	NE	0.28 UJ	0.28 UJ	0.28 UJ	NE	0.28 UJ
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon-113)	**0.93 J**	**0.64**	28 U	NE	NE	**0.63**	**0.74**	**0.67**	NE	**0.66**
1,2,4-Trichlorobenzene	15 UJ	3 UJ	130 UJ	6.8	NE	3 UJ	**0.4 J**	3 UJ	6.4	3 UJ
1,1,1-Trichloroethane	**6.6**	**6.8**	20 U	20.6	NE	0.44 U	**0.068 J**	0.44 U	2.6	0.44 U
1,1,2-Trichloroethane	2.2 U	0.44 U	20 U	1.5	NE	0.44 U	0.44 U	0.44 U	1.6	0.44 U
Trichloroethene	**1.5**	**1.6**	**1200**	4.2	5	0.21 U	0.21 U	0.21 U	1.3	0.21 U
Trichlorofluoromethane	**1.8 J**	**1.8**	**2.6 J**	18.1	NE	**1.7**	**1.5**	**1.5**	4.3	**1.7**
1,2,3-Trimethylbenzene	**3.3 J**	**4 J**	18 UJ	NE	NE	**0.85 J**	0.39 UJ	**0.76 J**	NE	0.39 UJ
1,3,5-Trimethylbenzene	**3.7 J**	**8.5 J**	18 U	3.7	NE	**0.58**	**0.36 J**	**0.47**	2.7	0.39 U
2,2,4-Trimethylpentane	**0.48 J**	**0.34 J**	42 U	NE	NE	**0.59 J**	**0.42 J**	**0.34 J**	NE	**0.35 J**
Vinyl bromide	1.7 U	0.35 U	16 U	NE	NE	0.35 U	0.35 U	0.35 U	NE	0.35 U
Vinyl chloride	1 U	0.2 U	9.3 U	1.9	NE	0.2 U	0.2 U	0.2 U	1.8	0.2 U
Other (%)										
Helium	0.17 U	0.21 U	**0.83**	NE	NE	NA	NA	NA	NE	NA

Notes:

ug/m^3 - micrograms per cubic meter
Possibly MGP-Related VOCs (ug/m^3)
VOCs - volatile organic compounds

[1]BASE Reference Source: NYSDOH, October 2006. Summary of Indoor and Outdoor Levels of Volatile Organic Compounds from selected public and commercial office buildings reported in various locations within office settings in NYS, 1994-1996.

NE - not established
NA - not analyzed

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the 90th percentile of the EPA BASE value (Background Concentration) it was compared to.

Validation Qualifiers:

J - estimated value
U - not detected at or above the reporting limit shown
UJ - not detected at or above the reporting limit shown and the reporting limit is estimated

Table 9. Matrix of Responsibility by Property Owner, National Grid, and Governing Agency
Skillman Street Former Holder Station
Brooklyn, New York

Task	NYSDEC	National Grid	Property Owner	Responsibility		
				NYSDEC	National Grid	Property Owner
Access Agreement (AA)		✓	✓		AA will be executed between the Property Owner and National Grid.	AA will be executed between the Property Owner and National Grid. Access to the Site will be provided to National Grid and NYSDEC.
Community Air Monitoring Plan (CAMP)	✓	✓		Review and Comment.	National Grid's environmental professional consultants will follow Site-specific CAMP procedures during intrusive work.	
Engineering Controls (EC) - a Cover System		✓	✓		Inspect ECs during annual inspection and when required by NYSDEC. Notify NYSDEC of known damage.	Maintenance and repair of the existing building foundation. Notify National Grid of damage.
Emergency Response due to EC Failure caused by Natural Disaster or Damage/Defect to Foundation, Structures or EC	✓	✓	✓	Review, Comment, and Approve.	Once National Grid is made aware, verbally notify NYSDEC by noon the day following notice by the property owner. National Grid's contracted qualified environmental professional conducts an inspection within 5 days of event. Written confirmation to NYSDEC within 7 days of event that summarizes event and actions taken. National Grid provides NYSDEC with follow-up status reports for ongoing responsive action within 45 days.	Verbal notice to National Grid as soon as possible.
Limited Intrusive Work (Small Scale)* performed under the Excavation Work Plan (EWP)	✓	✓	✓	Review and Comment.	Provide at a minimum and 60-days notice to NYSDEC before field activities begin. Smaller scale (i.e., "limited") intrusive activities will comply with the Excavation Work Plan and may require a Notice of Intrusion letter or a simple letter work plan. National Grid's contracted qualified environmental professional will provide visual, olfactory, and instrument-based soil screening and CAMP monitoring.	Provide notice to National Grid as soon as possible. Field activities can not begin until at least 60-days following National Grid providing notice to NYSDEC. All ground intrusive activities must follow the ISMP. Property Owner is responsible for the structural integrity of excavations and structures that may be affected. Property Owner is responsible for soil management in accordance with the EWP.
Field Sampling Plan (FSP)	✓	✓		Review and Comment.	National Grid's environmental professional consultants will follow Site-specific NYSDEC-approved FSP procedures.	
Future Property Development (Large Scale)*	✓	✓	✓	Review and Comment.	National Grid to notify NYSDEC once it has been notified by the property owner. Large-scale intrusive work will require additional investigation and remediation. Prepare a detailed Remedial Work Plan if required by NYSDEC based on investigation results.	Provide notice in writing to National Grid as early as possible, at a minimum 18 months.
Future Site Subdivision		✓	✓		National Grid to notify NYSDEC once it has been notified by the property owner.	Property owner notifies National Grid of the subdivision.
Groundwater Use and Fluids Management*		✓	✓		National Grid's contracted qualified environmental professional will containerize and coordinate off-site disposal of liquids generated from its groundwater sampling such as purge water, development water, and decontamination fluids.	Property owner is restricted from use of groundwater as a source of potable water or process water. Property Owner is responsible for fluids management during excavation in accordance with the EWP.
HASP	✓	✓	✓	Review and Comment.	Develop a Site-specific HASP to be included in the ISMP.	Develop a Site-specific HASP for any subsurface work.
Inspections	✓	✓		Review and Comment.	National Grid will complete inspections once per year and after severe weather that may affect ECs and monitoring. A Site Management Form will be completed and provided to NYSDEC.	

Table 9. Matrix of Responsibility by Property Owner, National Grid, and Governing Agency
Skillman Street Former Holder Station
Brooklyn, New York

Task	NYSDEC	National Grid	Property Owner	Responsibility		
				NYSDEC	National Grid	Property Owner
Institutional Control (IC) - Environmental Easement (EE)	✓	✓	✓	The EE will be executed between the Property Owner and the NYSDEC.	National Grid will prepare the EE package and complete and submit to NYSDEC a periodic certification of the IC.	The EE will be executed between the Property Owner and the NYSDEC. The EE requires compliance with the ISMP, restricts groundwater use, and allows the use and development of the Site for restricted residential, commercial, and industrial use subject to local
Metes and Bounds Survey		✓			National Grid will perform a Metes and Bounds (or similar) Survey to include in the Environmental Easement.	
Monitoring Plan - Groundwater Sampling	✓	✓		Review, Comment, and Approve.	Groundwater monitoring will be completed by National Grid as detailed in the ISMP. Modification requires NYSDEC approval.	
Monitoring Plan - Soil Vapor Intrusion (SVI) Sampling	✓	✓		If NYSDEC requires a SVI event. Review, Comment, and Approve.	National Grid's contracted environmental professional conducts a SVI to evaluate only MGP-related constituents in accordance with NYSDEC/NYSDOH guidelines, the QAPP, FSP, and ISMP, if required by NYSDEC.	
Monitoring Well Damage/Maintenance or Well Decommissioning	✓	✓		Review, Comment, and Approve.	National Grid will be responsible for any maintenance related to the groundwater monitoring well network. National Grid will notify NYSDEC prior to properly repairing, replacing, or decommissioning wells.	
Property Use Change (currently Restricted Use Commercial)	✓	✓	✓	Review and Comment.	Provide at a minimum 60 days notice to NYSDEC once it has been notified by the property owner. National Grid to review and confer with NYSDEC if ISMP revision and/or additional ICs are required. Following use change, National Grid to update ISMP and submit to NYSDEC, if required.	Provide notice to National Grid as soon as possible.
Property Ownership Change	✓	✓	✓	Notification receipt confirmation to Property Owner in 15 days (business).	Provide at a minimum 60 days notice to NYSDEC once it has been notified by the property owner. Notification receipt confirmation to Property Owner in 15 days (business).	Provide notice to National Grid as soon as possible. Within 15 days after transfer, confirm in writing to NYSDEC and National Grid the new owner's name, contact person, and contact information.
Quality Assurance Project Plan (QAPP)	✓	✓		Review and Comment.	National Grid's environmental professional consultants will follow Site-specific NYSDEC-approved QAPP procedures.	
Reporting	✓	✓	✓	Review and Comment.	National Grid's contracted qualified environmental professional will prepare and provide reports to NYSDEC as follows: - Groundwater sampling annually; - Soil Vapor Intrusion Report, as needed; - Severe Conditions Inspection Report annually; and - Periodic Review Report 16 months after ISMP is issued and annually (within 30 days of certification period) or as requested by NYSDEC.	Provide certification in writing that ICs remain in place and are complied with annually and when requested by National Grid or NYSDEC.
Record Of Decision (ROD)	✓			NYSDEC Submits ROD.		
Security			✓			Property Owner is responsible for site security.
Interim Site Management Plan (ISMP)	✓	✓	✓	Review and Approve ISMP and revisions. Append revisions to ISMP.	Prepare the ISMP and update when required.	Implement the ISMP for any ground intrusive work.

Notes:
* - The property owner is required to comply with the ISMP including all notifications to National Grid and provisions of the Excavation Work Plan. National Grid is only responsible for costs associated with MGP-related impacts.
Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the Site.

Table 10. Sampling Requirements and Schedule
Former Skillman Street Holder Station
Brooklyn, New York

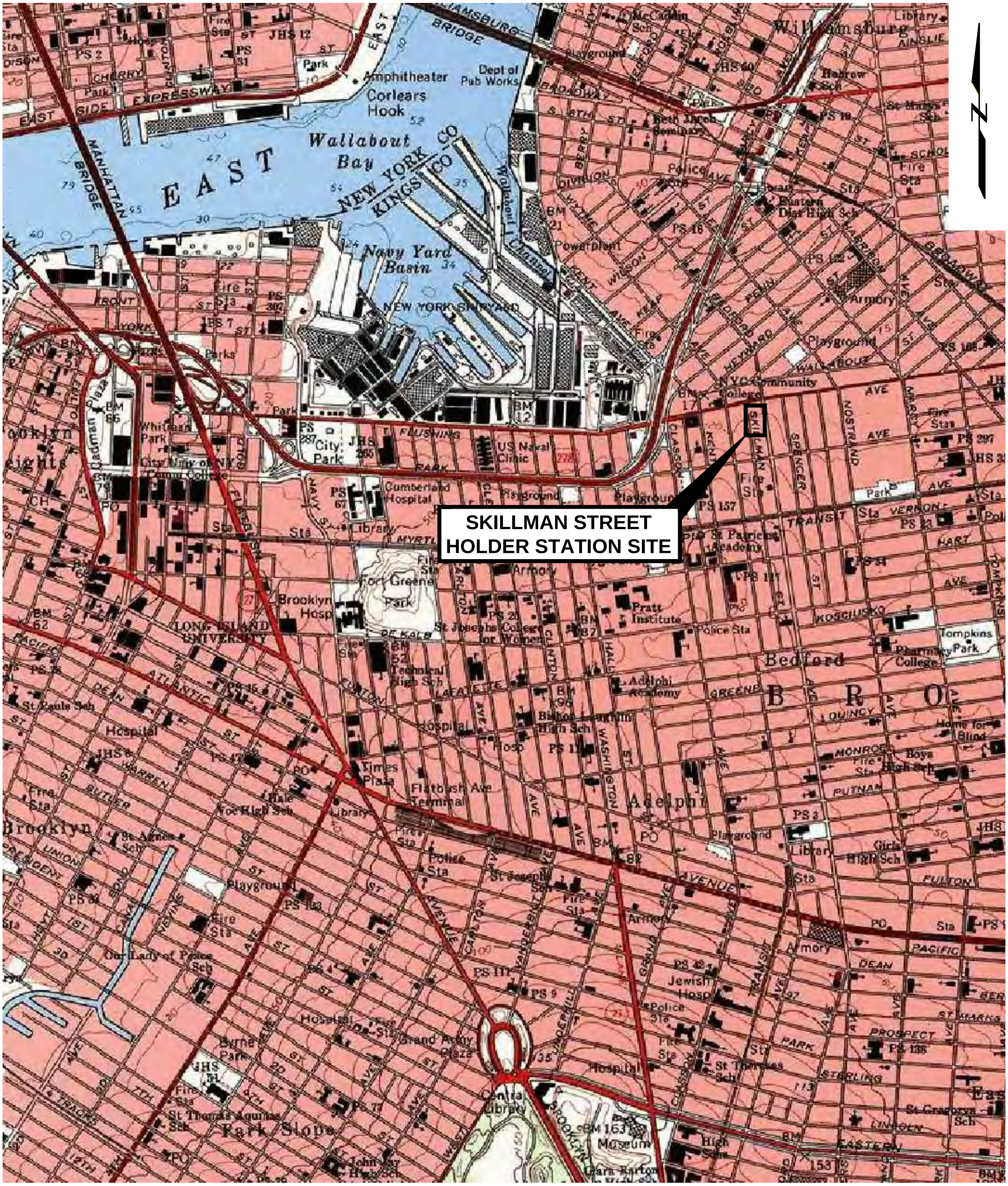
Monitoring Well Sampling Locations	Analytical Parameters				Schedule
	VOCs by EPA Method 8260	SVOCs by EPA Method 8270	TAL Metals by EPA Method 6010	Total Cyanide by EPA Method 9012	
SSMW-02 SSMW-03 SSMW-04 SSMW-05 SSMW-06 SSMW-07 SSMW-08	X	X	X	X	Annually
Soil Vapor (locations to be determined) if sampling of this medium becomes required)	To be determined	N/A	N/A	N/A	To be determined, if sampling of soil vapor becomes required

Table 11. Schedule of Interim Monitoring/Inspection Reports
Former Skillman Street Holder Station
Brooklyn, New York

Task/Report	**Reporting Frequency***
Groundwater Sampling Report	Annually
Soil Vapor Intrusion Sampling Report	To Be Determined (TBD)
Severe Condition Inspection Report	As Needed
Periodic Review Report	Annually, or as otherwise determined by the Department

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

Figures



SOURCE: Map created with TOPO! ® © 2001 National Geographic (www.nationalgeographic.com/topo)

Interim Site Management Plan Skillman Street Holder Station Brooklyn, New York	GEI Consultants	SITE LOCATION MAP
nationalgrid	Project 093080	March 2017 Fig. 1

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LEGEND:

SITE BOUNDARY(APPROXIMATE)

PARCEL BOUNDARY

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.

0 80' 160'

SCALE: 1" = 80'

Interim Site Management Plan Former Skillman Street Holder Station Brooklyn, New York	GEI Consultants	SITE LAYOUT
nationalgrid	Project 093080	March 2017 Fig. 2

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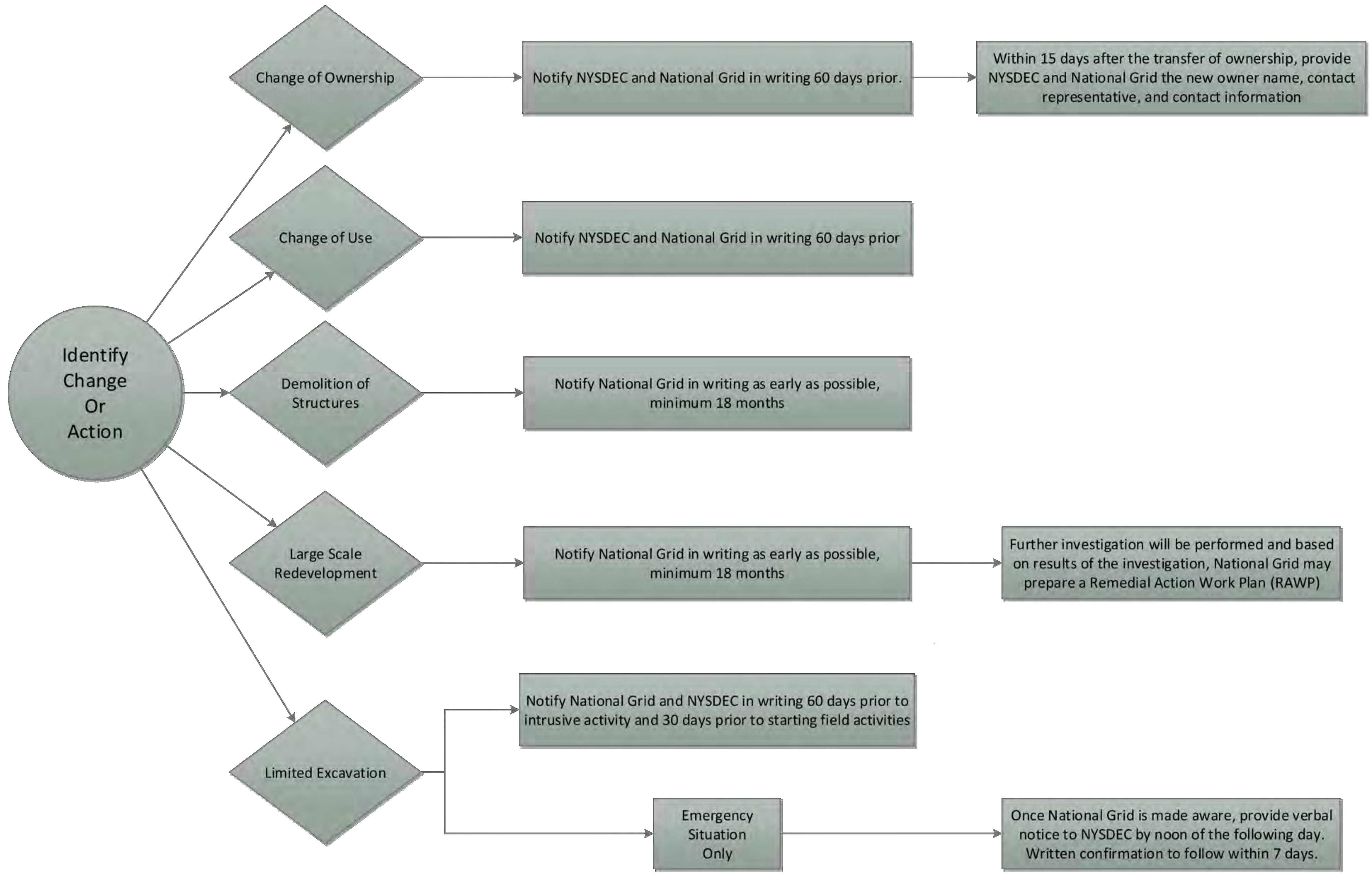

Interim Site Management Plan Former Skillman Street Holder Station Brooklyn, New York	GEI Consultants	PROPERTY OWNER DECISION TREE FOR INTRUSIVE ACTIVITIES ON-SITE
nationalgrid	Project 093080	March 2017 Fig. 3

LEGEND:

SITE BOUNDARY(APPROXIMATE)

PARCEL BOUNDARY

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.

0 80' 160'

SCALE: 1" = 80'

Interim Site Management Plan Former Skillman Street Holder Station Brooklyn, New York	GEI Consultants	SITE PROPERTY BOUNDARIES BY OWNER
nationalgrid	Project 093080	March 2017 Fig. 4

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LEGEND:

- SITE BOUNDARY(APPROXIMATE)
- HISTORICAL GAS HOLDER
- A — A' CROSS SECTION

SAMPLE LOCATIONS:

SSGP-03/ SSMW-02	SOIL BORING/ MONITORING WELL
SSGP-14/ SSGW-05	SOIL BORING/TEMPORARY GROUNDWATER SAMPLING POINT
SSGP-08	SOIL BORING
SSSV-01	SOIL VAPOR SAMPLE
SSOA-01	OUTDOOR AIR SAMPLE
SSIA-01	INDOOR AIR SAMPLE
SSTP-01	TEST PIT

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11, 6/23/11, AND 6/28/13. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.
3. INDOOR AND OUTDOOR AIR SAMPLE LOCATIONS WERE NOT SURVEYED AND ARE APPROXIMATE.

0 80' 160'

SCALE: 1" = 80'

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

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HISTORIC SITE CONDITIONS, SAMPLE LOCATIONS, AND CROSS-SECTION BASELINES

Project 093080 | March 2017 | Fig. 5

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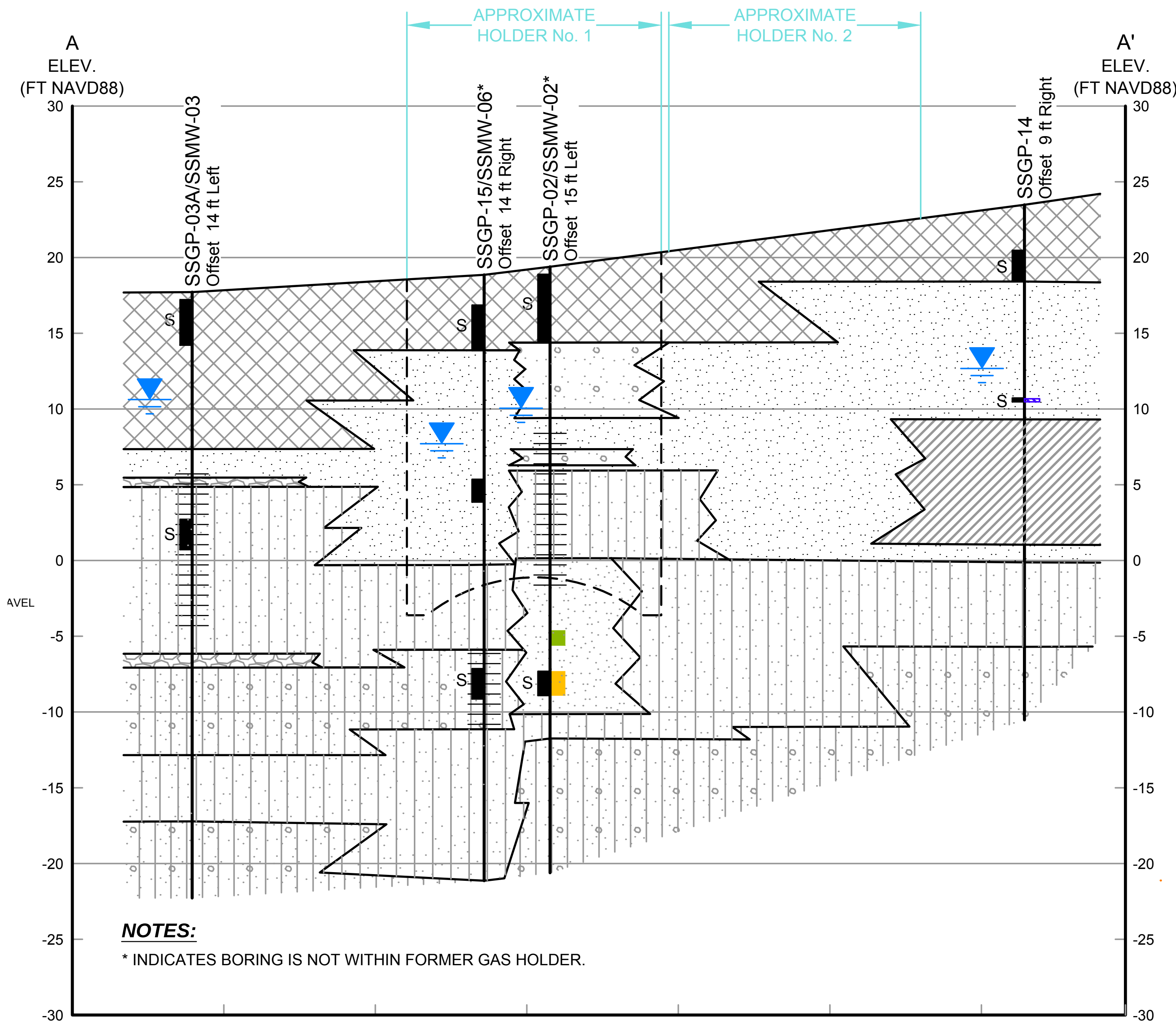

NOTES:

* INDICATES BORING IS NOT WITHIN FORMER GAS HOLDER.

LEGEND

SS-GP-02/ SS-MW-02	SOIL BORING/MONITORING WELL IDENTIFICATION
	OBSERVED APPARENT GROUNDWATER TABLE BASED UPON BORING INFORMATION
S	ANALYTICAL SOIL SAMPLE INTERVAL
	WELL SCREEN INTERVAL
NAVD88	NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

- FILL
- SAND
- SAND WITH SILT
- SAND WITH GRAVEL
- SILTY SAND
- SILTY SAND WITH GRAVEL
- GRAVEL
- CLAY

PHYSICAL OBSERVATIONS

- TAR STAINING, SHEEN, AND TAR/NAPHTHA ODORS
- BLEBS, GLOBS, LENSES, COATINGS AND TAR/ NAPTHA ODORS
- SHEEN/ STAINING PETROLEUM ODORS

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11, 6/23/11, AND 6/28/13. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.
3. THE BROOKLYN UNION GAS CO. AND SUBSIDIARY COMPANIES, DIAGRAM OF HOLDERS SHEET 3 SHOWING HEIGHTS & RELATIONS TO BUILDING LINES, DRAWING NO. 6-B-50, DEC. 22, 1913.

HORIZONTAL SCALE: 1" = 60'
0 60' 120'

0 10' 20'
VERTICAL SCALE: 1" = 10'
NOTE: 6X VERTICAL EXAGGERATION

Interim Site Management Plan Former Skillman Street Holder Station Brooklyn, New York	GEI Consultants	CROSS-SECTION A-A'
nationalgrid	Project 093080	March 2017 Fig. 6

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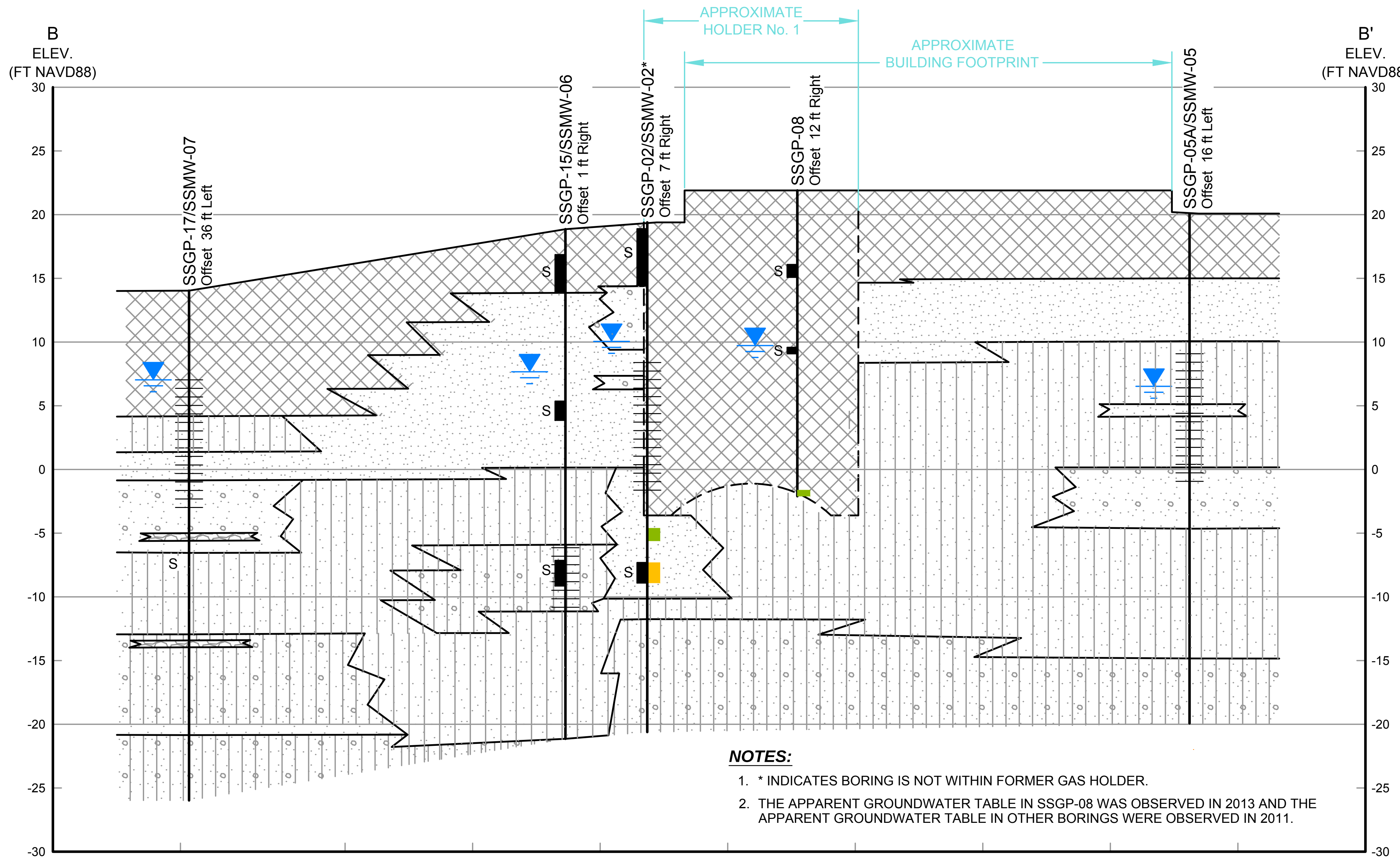

NOTES:

1. * INDICATES BORING IS NOT WITHIN FORMER GAS HOLDER.
2. THE APPARENT GROUNDWATER TABLE IN SSGP-08 WAS OBSERVED IN 2013 AND THE APPARENT GROUNDWATER TABLE IN OTHER BORINGS WERE OBSERVED IN 2011.

LEGEND

SS-GP-02/ SS-MW-02 — SOIL BORING/MONITORING WELL IDENTIFICATION

OBSERVED APPARENT GROUNDWATER TABLE BASED UPON BORING INFORMATION

S — ANALYTICAL SOIL SAMPLE INTERVAL

WELL SCREEN INTERVAL

NAVD88 — NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

- FILL
- SAND
- SAND WITH SILT
- SAND WITH GRAVEL
- SILTY SAND
- SILTY SAND WITH GRAVEL
- GRAVEL
- CLAY

PHYSICAL OBSERVATIONS

- TAR STAINING, SHEEN, AND TAR/NAPHTHA ODORS
- BLEBS, GLOBS, LENSES, COATINGS AND TAR/ NAPTHA ODORS
- SHEEN/ STAINING PETROLEUM ODORS

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11, 6/23/11, AND 6/28/13. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.
3. THE BROOKLYN UNION GAS CO. AND SUBSIDIARY COMPANIES, DIAGRAM OF HOLDERS SHEET 3 SHOWING HEIGHTS & RELATIONS TO BUILDING LINES, DRAWING NO. 6-B-50, DEC. 22, 1913.

HORIZONTAL SCALE: 1" = 60'

0 60' 120'

0 10' 20'

VERTICAL SCALE: 1" = 10'

NOTE: 6X VERTICAL EXAGGERATION

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

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CROSS-SECTION B-B'

Project 093080 | March 2017 | Fig. 7

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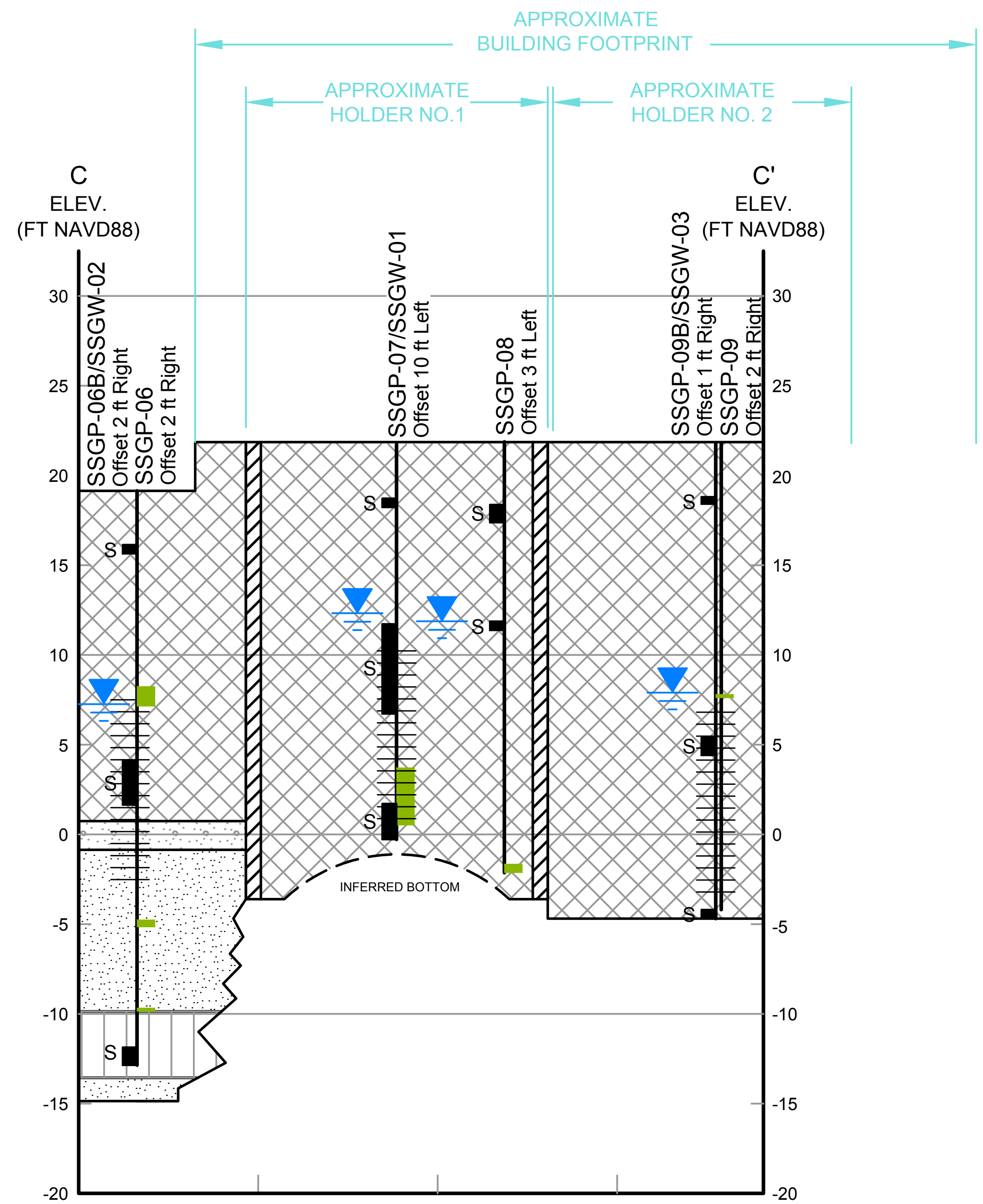

LEGEND

SS-GP-02/ SS-MW-02 — SOIL BORING/MONITORING WELL IDENTIFICATION

OBSERVED APPARENT GROUNDWATER TABLE BASED UPON BORING INFORMATION

S — ANALYTICAL SOIL SAMPLE INTERVAL

WELL SCREEN INTERVAL

NAVD88 — NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

FILL
SAND
SAND WITH SILT
SAND WITH GRAVEL
SILTY SAND
SILTY SAND WITH GRAVEL
GRAVEL
CLAY

PHYSICAL OBSERVATIONS

TAR STAINING, SHEEN, AND TAR/NAPHTHA ODORS

BLEBS, GLOBS, LENSES, COATINGS AND TAR/ NAPTHA ODORS

SHEEN/ STAINING PETROLEUM ODORS

NOTES:

1. THE APPARENT GROUNDWATER TABLE FOR BORINGS WAS OBSERVED IN 2013.

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11, 6/23/11, AND 6/28/13. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.
3. THE BROOKLYN UNION GAS CO. AND SUBSIDIARY COMPANIES, DIAGRAM OF HOLDERS SHEET 3 SHOWING HEIGHTS & RELATIONS TO BUILDING LINES, DRAWING NO. 6-B-50, DEC. 22, 1913.

HORIZONTAL SCALE: 1" = 60'
0 60' 120'

0 10' 20'
VERTICAL SCALE: 1" = 10'
NOTE: 6X VERTICAL EXAGGERATION

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Brooklyn, New York

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CROSS-SECTION C-C'

Project 093080 | March 2017 | Fig. 8

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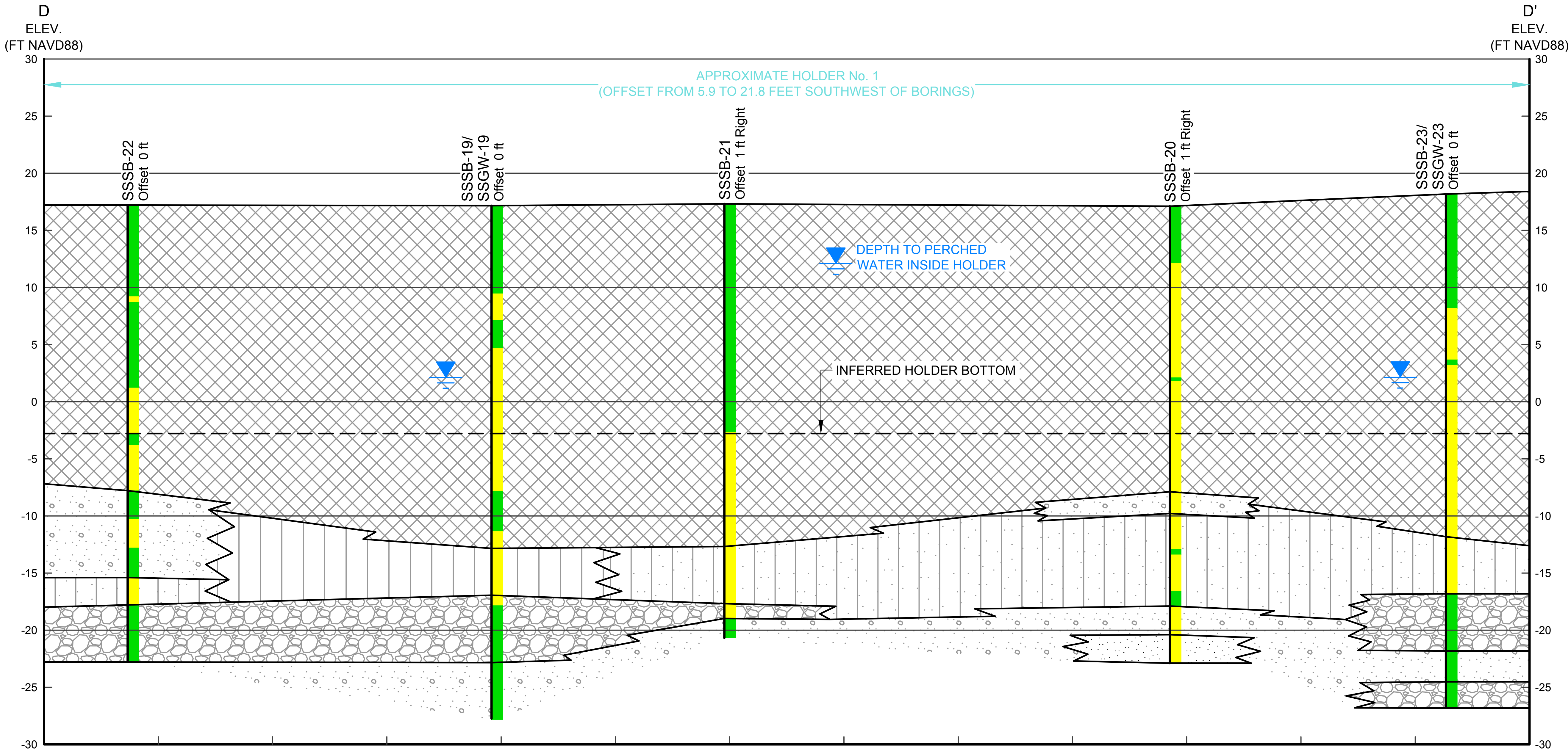

HORIZONTAL SCALE: 1" = 5'

0 5 10

0 10 20

VERTICAL SCALE: 1" = 10'

NOTE: 0.5xVERTICAL EXAGGERATION

LEGEND

SSSB-19/ SSGW-19 — SOIL BORING/TEMPORARY MONITORING WELL IDENTIFICATION

MEASURED GROUNDWATER TABLE PRIOR TO SAMPLING

NAVD88 — NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

- FILL
- SAND
- SANDY SILT
- SAND WITH GRAVEL
- SILTY SAND
- GRAVEL

PHYSICAL OBSERVATIONS

- NO PHYSICAL IMPACTS
- STAINING, ODORS

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

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CROSS SECTION D-D'

Project 093080 | March 2017 | Fig. 9

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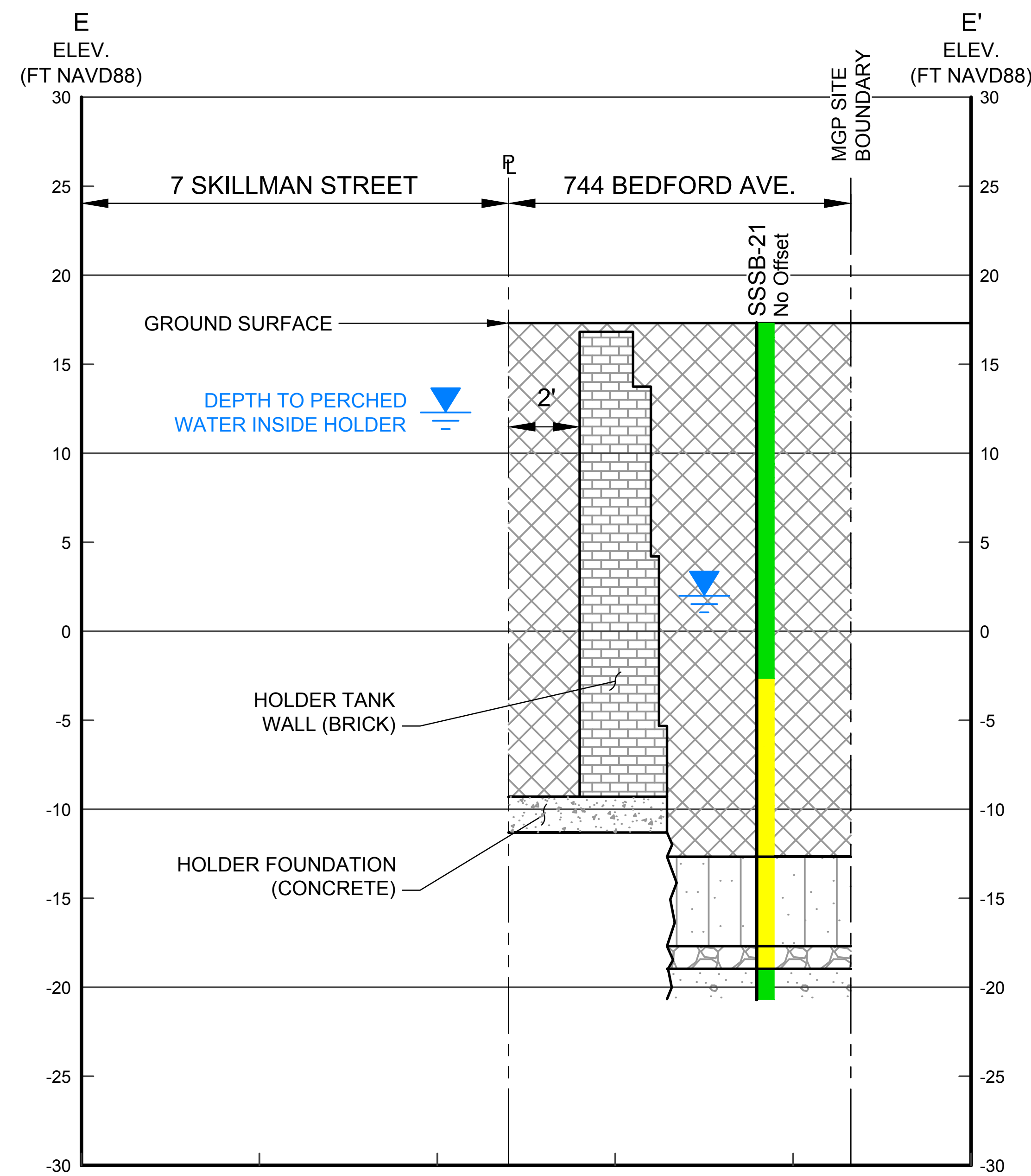

HORIZONTAL SCALE: 1" = 5'
0 5 10

0 10 20
VERTICAL SCALE: 1" = 10'
NOTE: 0.5xVERTICAL EXAGGERATION

NOTE:

1. HOLDER FOUNDATION AND WALL PROFILE ESTIMATED BASED ON THE FOLLOWING SOURCES: (1) TEST PIT CONDUCTED ON MARCH 8, 2016, (2) THE BROOKLYN UNION GAS CO. DRAWING TITLED, "DIAGRAM OF HOLDERS SHEET 3, DRAWING NUMBER 6-B-50, DATED DECEMBER 22, 1913, (3) GAS HOLDER INFORMATION DATED DECEMBER 31, 1920, PROVIDED BY NATIONAL GRID.

LEGEND

SSSB-19/ SSGW-19	SOIL BORING/TEMPORARY MONITORING WELL IDENTIFICATION
	MEASURED GROUNDWATER TABLE PRIOR TO SAMPLING
NAVD88	NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

- FILL
- SAND
- SANDY SILT
- SAND WITH GRAVEL
- SILTY SAND
- GRAVEL

PHYSICAL OBSERVATIONS

- NO PHYSICAL IMPACTS
- STAINING, ODORS

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

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CROSS SECTION E-E'

Project 093080	March 2017	Fig. 10

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LOCATION OF DEWATERING WELLS

0 800' 1600'

SCALE: 1" = 800'

LEGEND:

	SITE BOUNDARY(APPROXIMATE)
	HISTORICAL GAS HOLDER
SSMW-02	MONITORING WELL
SSGW-05	TEMPORARY GROUNDWATER SAMPLING POINT
7.5	GROUNDWATER CONTOUR (FEET NAVD)
8.04	GROUNDWATER ELEVATION (FEET NAVD)
	INFERRED GROUNDWATER FLOW DIRECTION
NAVD	NORTH AMERICAN VERTICAL DATUM

NOTE:

SSMW-01 IS LOCATED IN OU-2 AND IS INCLUDED IN THIS FIGURE BECAUSE IT WAS GAUGED TO DEVELOP GROUNDWATER CONTOURS FOR THE SITE.

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11 AND 6/23/11. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.

0 100' 200'

SCALE: 1" = 100'

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

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GROUNDWATER CONTOURS

Project 093080 | March 2017 | Fig. 11

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Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-17 (10-12) 8/22/2011
BTEX (mg/kg)			
Total BTEX	NE	NE	ND
Other VOCs (mg/kg)			
Total VOCs	NE	NE	ND
PAHs (mg/kg)			
Total PAHs	NE	NE	**0.181**
Other SVOCs (mg/kg)			
Total SVOCs	NE	NE	**0.181**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	**1.004**	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**1.004**	ND

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-06 (3-3.5) 6/27/2013	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013
BTEX (mg/kg)					
Total BTEX	NE	NE	ND	ND	ND
Other VOCs (mg/kg)					
Total VOCs	NE	NE	**0.0313**	**0.0586**	ND
PAHs (mg/kg)					
Benzo(b)fluoranthene	1	1	**1.1**	0.039 U	0.036 U
Total PAHs	NE	NE	**10.587**	ND	ND
Other SVOCs (mg/kg)					
Total SVOCs	NE	NE	**10.587**	ND	ND
Metals (mg/kg)					
Copper	50	270	**63**	**22**	**25**
Lead	63	1000	**160 J**	**4.6 J**	**7.1 J**
Mercury	0.18	2.8	**0.38**	0.02 U	0.018 U
Nickel	30	310	**31**	8.7 U	**11**
Zinc	109	10000	**280**	**23**	**31**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	**0.665**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**0.021**	**0.665**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	**0.01517**
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	**0.02617**
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	**1.786**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	ND	**1.786**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-18 (10-12) 8/23/2011
BTEX (mg/kg)			
Total BTEX	NE	NE	ND
Other VOCs (mg/kg)			
Total VOCs	NE	NE	ND
PAHs (mg/kg)			
Total PAHs	NE	NE	**0.744**
Other SVOCs (mg/kg)			
Total SVOCs	NE	NE	**0.744**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010
BTEX (mg/kg)				
Toluene	0.7	100	0.0057 U	**160**
Ethylbenzene	1	41	0.0057 U	**220**
Total Xylene	0.26	100	0.0057 U	**840**
Total BTEX	NE	NE	**0.001**	**1220**
Other VOCs (mg/kg)				
Acetone	0.05	100	**0.091 J**	58 UJ
Total VOCs	NE	NE	**0.092**	**1620**
PAHs (mg/kg)				
Naphthalene	12	100	**0.21 J**	**1000**
Total PAHs	NE	NE	**2.067**	**1218.7**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**2.113**	**1218.7**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-07 (3-4) 6/26/2013	Duplicate of: SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013
BTEX (mg/kg)						
Benzene	0.06	4.8	**0.0013 J**	**0.0011 J**	0.0013 UJ	**0.61 J**
Toluene	0.7	100	0.0024 UJ	0.0011 UJ	0.0013 UJ	**12 J**
Ethylbenzene	1	41	0.0024 UJ	0.0011 UJ	0.0013 UJ	**29 J**
o-Xylene	0.26	100	0.0024 UJ	0.0011 UJ	0.0013 UJ	**11 J**
m/p Xylene	0.26	100	0.0024 UJ	0.0011 UJ	0.0013 UJ	**25 J**
Total BTEX	NE	NE	**0.0013**	**0.0011**	0.0013 UJ	**77.61**
Other VOCs (mg/kg)						
Total VOCs	NE	NE	**0.0358**	**0.0291**	ND	**80.85**
PAHs (mg/kg)						
Benzo(b)fluoranthene	1	1	**0.85**	**1.3**	0.043 U	0.22 U
Benzo(a)anthracene	1	1	**1.1**	**1.5**	**0.055**	0.22 U
Benzo(a)pyrene	1	1	**0.86**	**1.4**	0.043 U	0.22 U
Chrysene	1	3.9	**0.96**	**1.5**	0.43 U	2.2 U
Indeno(1,2,3-cd)pyrene	0.5	0.5	**0.61 J**	**1.2 J**	0.043 U	0.22 U
Naphthalene	12	100	0.37 U	0.37 U	0.43 U	**38 J**
Total PAHs	NE	NE	**10.638**	**16.58**	0.055	**46.1**
Other SVOCs (mg/kg)						
Total SVOCs	NE	NE	**10.638**	**16.58**	**0.055**	**46.1**
Metals (mg/kg)						
Lead	63	400	**270 J**	**330 J**	**56 J**	**160 J**
Mercury	0.18	0.81	**0.31**	**0.28**	**0.033**	**0.07**
Nickel	30	310	**21**	**20**	**69**	**41**
Zinc	109	10000	**230**	**170**	**49**	**80**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	**1.182**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	ND	**1.182**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	**0.338**	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**0.338**	**ND**
Metals (mg/kg)				
Copper	50	270	**63**	**25**
Lead	63	400	**330 J**	**73 J**
Nickel	30	310	**170**	**36**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**0.12**	**0.061**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-09 (3.0-3.4) 6/25/2013	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013
BTEX (mg/kg)					
Total BTEX	NE	NE	ND	ND	ND
Other VOCs (mg/kg)					
Total VOCs	NE	NE	ND	ND	ND
PAHs (mg/kg)					
Total PAHs	NE	NE	ND	ND	ND
Other SVOCs (mg/kg)					
Total SVOCs	NE	NE	ND	ND	ND

LEGEND:

SITE BOUNDARY(APPROXIMATE)

SSGP-06 GEOPROBE® BORING

6 NYCRR -New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

6 NYCRR 375 SCO UNRESTRICTED USE - regulatory comparison against NYCRR, Chapter IV, Part 375-6 Unrestricted Use Soil Cleanup Objectives

6 NYCRR 375 SCO RESTRICTED USE RESTRICTED-RESIDENTIAL - regulatory comparison against NYCRR, Chapter IV, Part 375-6 Restricted Use Restricted-Residential Soil Cleanup Objectives

mg/kg	milligrams/kilogram or parts per million (ppm)
ft bgs	feet below ground surface
BTEX	benzene, toluene, ethlybenzene, and xylene
PAHs	polycyclic aromatic hydrocarbons
VOCs	volatile organic compounds
SVOCs	semi-volatile organic compounds
NE	not established
ND	not detected; total concentration is listed as ND because no compounds were detected in the group
U	indicates not detected at or above the reporting limit shown
J	estimated value
BOLD	indicates a detected concentration
BOLD (grey)	indicates that the detected result value exceeds established 6 NYCRR SCO UNRESTRICTED USE
BOLD (orange)	indicates that the detected result value exceeds established 6 NYCRR SCO RESTRICTED USE RESTRICTED RESIDENTIAL

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11 AND 6/23/11. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.

0 80' 160'

SCALE: 1" = 80'

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

nationalgrid

SUBSURFACE SOIL ANALYTICAL SUMMARY (mg/kg)

Project 093080 | March 2017 | Fig. 12

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Sample Name:	UNRESTRICTED USE SCO	SSGP-06	SSGP-06	SSGP-06
Sample Depth (feet):		(3-3.5)	(15-17)	(31-32)
Sample Date:		6/27/2013	6/27/2013	6/27/2013
BTEX (mg/kg)				
Total BTEX	NE	ND	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	**0.0313**	**0.0586**	ND
PAHs (mg/kg)				
Benzo(b)fluoranthene	1	**1.1**	0.039 U	0.036 U
Total PAHs	NE	**10.587**	ND	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	**10.587**	ND	ND
Metals (mg/kg)				
Copper	50	**63**	**22**	**25**
Lead	63	**160 J**	**4.6 J**	**7.1 J**
Mercury	0.18	**0.38**	0.02 U	0.018 U
Nickel	30	**31**	8.7 U	**11**
Zinc	109	**280**	**23**	**31**

Sample Name:	UNRESTRICTED USE SCO	SSGP-03A	SSGP-03A
Sample Depth (feet):		(0.5-3.5)	(15-17)
Sample Date:		8/12/2010	8/12/2010
BTEX (mg/kg)			
Total BTEX	NE	ND	ND
Other VOCs (mg/kg)			
Total VOCs	NE	ND	ND
PAHs (mg/kg)			
Total PAHs	NE	**1.004**	ND
Other SVOCs (mg/kg)			
Total SVOCs	NE	**1.004**	ND

Sample Name:	UNRESTRICTED USE SCO	SSGP-04	SSGP-04
Sample Depth (feet):		(0.5-5)	(9.5-10.5)
Sample Date:		8/20/2010	8/20/2010
BTEX (mg/kg)			
Total BTEX	NE	ND	ND
Other VOCs (mg/kg)			
Total VOCs	NE	ND	ND
PAHs (mg/kg)			
Total PAHs	NE	ND	**0.665**
Other SVOCs (mg/kg)			
Total SVOCs	NE	**0.021**	**0.665**

LEGEND:

SITE BOUNDARY(APPROXIMATE)

SSGP-06 GEOPROBE® BORING

6 NYCRR -New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

6 NYCRR 375 SCO UNRESTRICTED USE - regulatory comparison against NYCRR, Chapter IV, Part 375-6 Unrestricted Use Soil Cleanup Objectives

mg/kg	milligrams/kilogram or parts per million (ppm)
ft bgs	feet below ground surface
BTEX	benzene, toluene, ethlybenzene, and xylene
PAHs	polycyclic aromatic hydrocarbons
VOCs	volatile organic compounds
SVOCs	semi-volatile organic compounds
NE	not established
ND	not detected; total concentration is listed as ND because no compounds were detected in the group
U	indicates not detected at or above the reporting limit shown
J	estimated value
BOLD	indicates a detected concentration
BOLD	indicates that the detected result value exceeds established 6 NYCRR SCO UNRESTRICTED USE

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11 AND 6/23/11. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.

Sample Name:	UNRESTRICTED USE SCO	SSGP-17
Sample Depth (feet):		(10-12)
Sample Date:		8/22/2011
BTEX (mg/kg)		
Total BTEX	NE	ND
Other VOCs (mg/kg)		
Total VOCs	NE	ND
PAHs (mg/kg)		
Total PAHs	NE	**0.181**
Other SVOCs (mg/kg)		
Total SVOCs	NE	**0.181**

Sample Name:	UNRESTRICTED USE SCO	SSGP-15	SSGP-15
Sample Depth (feet):		(2-5)	(13.5-15)
Sample Date:		8/19/2010	8/19/2010
BTEX (mg/kg)			
Total BTEX	NE	ND	**0.01517**
Other VOCs (mg/kg)			
Total VOCs	NE	ND	**0.02617**
PAHs (mg/kg)			
Total PAHs	NE	ND	**1.786**
Other SVOCs (mg/kg)			
Total SVOCs	NE	ND	**1.786**

Sample Name:	UNRESTRICTED USE SCO	SSGP-18
Sample Depth (feet):		(10-12)
Sample Date:		8/23/2011
BTEX (mg/kg)		
Total BTEX	NE	ND
Other VOCs (mg/kg)		
Total VOCs	NE	ND
PAHs (mg/kg)		
Total PAHs	NE	**0.744**
Other SVOCs (mg/kg)		
Total SVOCs	NE	**0.744**

Sample Name:	UNRESTRICTED USE SCO	SSGP-08	SSGP-08
Sample Depth (feet):		(3.5-4.5)	(10-10.5)
Sample Date:		6/25/2013	6/25/2013
BTEX (mg/kg)			
Total BTEX	NE	ND	ND
Other VOCs (mg/kg)			
Total VOCs	NE	ND	ND
PAHs (mg/kg)			
Total PAHs	NE	**0.338**	ND
Other SVOCs (mg/kg)			
Total SVOCs	NE	**0.338**	**ND**
Metals (mg/kg)			
Copper	50	**63**	**25**
Lead	63	**330 J**	**73 J**
Nickel	30	**170**	**36**

Sample Name:	UNRESTRICTED USE SCO	SSGP-02	SSGP-02
Sample Depth (feet):		(0.5-5)	(26.7-28.3)
Sample Date:		8/9/2010	8/9/2010
BTEX (mg/kg)			
Toluene	0.7	0.0057 U	**160**
Ethylbenzene	1	0.0057 U	**220**
Total Xylene	0.26	0.0057 U	**840**
Total BTEX	NE	**0.001**	**1220**
Other VOCs (mg/kg)			
Acetone	0.05	**0.091 J**	58 UJ
Total VOCs	NE	**0.092**	**1620**
PAHs (mg/kg)			
Naphthalene	12	**0.21 J**	
Total PAHs	NE	**2.067**	**1218.7**
Other SVOCs (mg/kg)			
Total SVOCs	NE	**2.113**	**1218.7**

Sample Name:	UNRESTRICTED USE SCO	SSGP-05	SSGP-05
Sample Depth (feet):		(0.5-5)	(15)
Sample Date:		8/16/2010	8/16/2010
BTEX (mg/kg)			
Total BTEX	NE	ND	ND
Other VOCs (mg/kg)			
Total VOCs	NE	ND	ND
PAHs (mg/kg)			
Total PAHs	NE	ND	ND
Other SVOCs (mg/kg)			
Total SVOCs	NE	**0.12**	**0.061**

Sample Name:	UNRESTRICTED USE SCO	SSGP-07	Duplicate of: SSGP-07	SSGP-07	SSGP-07
Sample Depth (feet):		(3-4)	(3-4)	(10-15)	(20-22)
Sample Date:		6/26/2013	6/26/2013	6/26/2013	6/26/2013
BTEX (mg/kg)					
Benzene	0.06	**0.0013 J**	**0.0011 J**	0.0013 UJ	**0.61 J**
Toluene	0.7	0.0024 UJ	0.0011 UJ	0.0013 UJ	**12 J**
Ethylbenzene	1	0.0024 UJ	0.0011 UJ	0.0013 UJ	**29 J**
o-Xylene	0.26	0.0024 UJ	0.0011 UJ	0.0013 UJ	**11 J**
m/p Xylene	0.26	0.0024 UJ	0.0011 UJ	0.0013 UJ	**25 J**
Total BTEX	NE	**0.0013**	**0.0011**	0.0013 UJ	**77.61**
Other VOCs (mg/kg)					
Total VOCs	NE	**0.0358**	**0.0291**	ND	**80.85**
PAHs (mg/kg)					
Benzo(b)fluoranthene	1	**0.85**	**1.3**	0.043 U	0.22 U
Benzo(a)anthracene	1	**1.1**	**1.5**	**0.055**	0.22 U
Benzo(a)pyrene	1	**0.86**	**1.4**	0.043 U	0.22 U
Chrysene	1	**0.96**	**1.5**	0.43 U	2.2 U
Indeno(1,2,3-cd)pyrene	0.5	**0.61 J**	**1.2 J**	0.043 U	0.22 U
Naphthalene	12	0.37 U	0.37 U	0.43 U	**38 J**
Total PAHs	NE	**10.638**	**16.58**	0.055	**46.1**
Other SVOCs (mg/kg)					
Total SVOCs	NE	**10.638**	**16.58**	**0.055**	**46.1**
Metals (mg/kg)					
Lead	63	**270 J**	**330 J**	**56 J**	**160 J**
Mercury	0.18	**0.31**	**0.28**	**0.033**	**0.07**
Nickel	30	**21**	**20**	**69**	**41**
Zinc	109	**230**	**170**	**49**	**80**

Sample Name:	UNRESTRICTED USE SCO	SSGP-14	SSGP-14
Sample Depth (feet):		(3-5)	(12.75-13)
Sample Date:		8/9/2010	8/9/2010
BTEX (mg/kg)			
Total BTEX	NE	ND	ND
Other VOCs (mg/kg)			
Total VOCs	NE	ND	ND
PAHs (mg/kg)			
Total PAHs	NE	ND	**1.182**
Other SVOCs (mg/kg)			
Total SVOCs	NE	ND	**1.182**

Sample Name:	UNRESTRICTED USE SCO	SSGP-09	SSGP-09	SSGP-09B
Sample Depth (feet):		(3.0-3.4)	(16.4-17.4)	(26-26.5)
Sample Date:		6/25/2013	6/25/2013	6/26/2013
BTEX (mg/kg)				
Total BTEX	NE	ND	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	ND	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	ND	ND	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	ND	ND	ND

0 80' 160'

SCALE: 1" = 80'

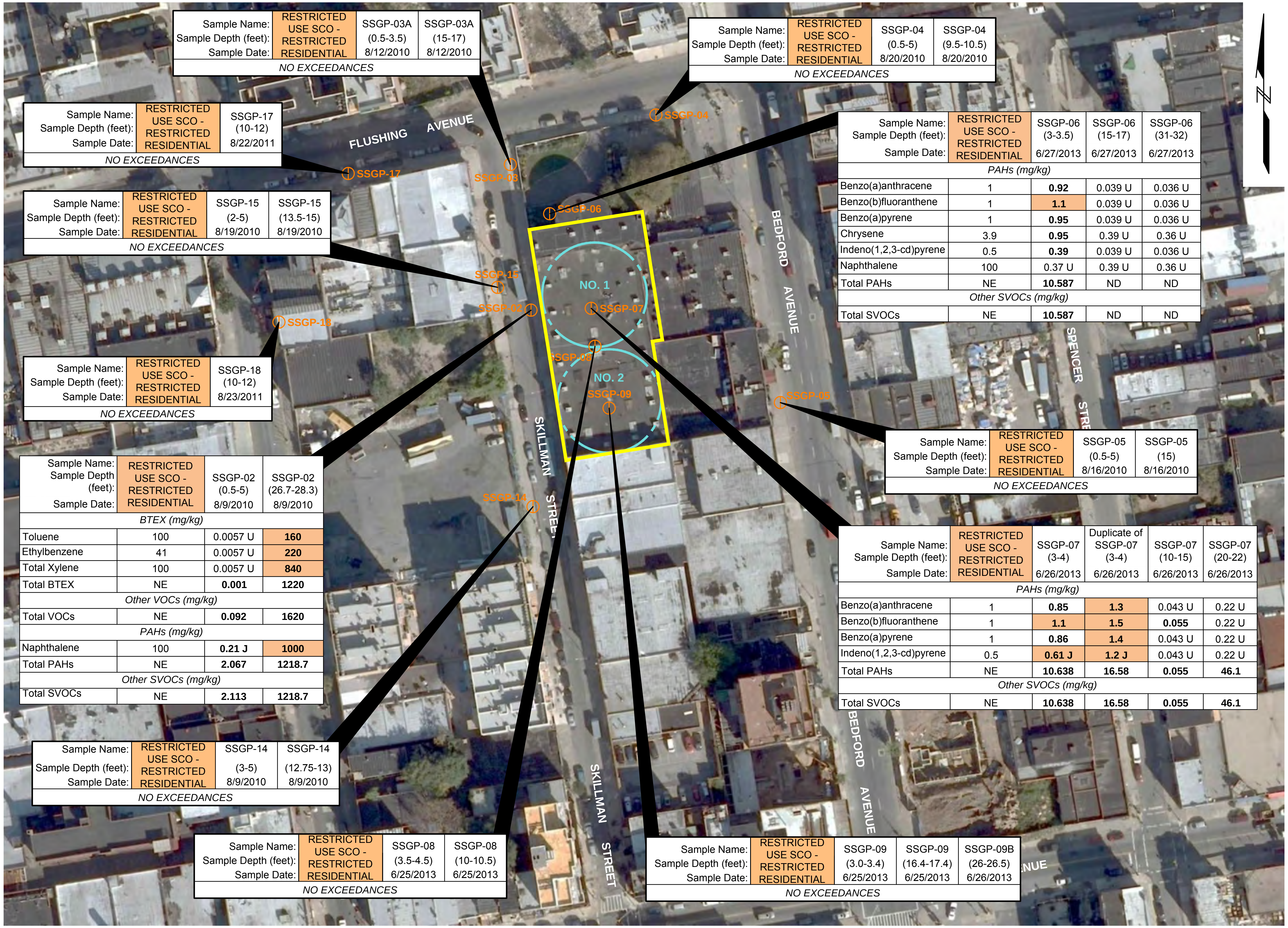
Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

nationalgrid

LOCATION OF SOIL CONTAMINATION ABOVE UNRESTRICTED LEVELS (mg/kg)

Project 093080 | March 2017 | Fig. 13

\\gtb1v-fs01\ I:\Project\National Grid\Skillman Street\093080\Site Management Plan\Drawings\Figures\ISMP\Skillman St-ISMP FIGS.dwg - 3/10/2017



Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010
NO EXCEEDANCES			

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010
NO EXCEEDANCES			

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-17 (10-12) 8/22/2011
NO EXCEEDANCES		

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-06 (3-3.5) 6/27/2013	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013
PAHs (mg/kg)				
Benzo(a)anthracene	1	**0.92**	0.039 U	0.036 U
Benzo(b)fluoranthene	1	**1.1**	0.039 U	0.036 U
Benzo(a)pyrene	1	**0.95**	0.039 U	0.036 U
Chrysene	3.9	**0.95**	0.39 U	0.36 U
Indeno(1,2,3-cd)pyrene	0.5	**0.39**	0.039 U	0.036 U
Naphthalene	100	0.37 U	0.39 U	0.36 U
Total PAHs	NE	**10.587**	ND	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	**10.587**	ND	ND

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010
NO EXCEEDANCES			

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-18 (10-12) 8/23/2011
NO EXCEEDANCES		

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010
NO EXCEEDANCES			

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010
BTEX (mg/kg)			
Toluene	100	0.0057 U	**160**
Ethylbenzene	41	0.0057 U	**220**
Total Xylene	100	0.0057 U	**840**
Total BTEX	NE	**0.001**	**1220**
Other VOCs (mg/kg)			
Total VOCs	NE	**0.092**	**1620**
PAHs (mg/kg)			
Naphthalene	100	**0.21 J**	**1000**
Total PAHs	NE	**2.067**	**1218.7**
Other SVOCs (mg/kg)			
Total SVOCs	NE	**2.113**	**1218.7**

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-07 (3-4) 6/26/2013	Duplicate of SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013
PAHs (mg/kg)					
Benzo(a)anthracene	1	**0.85**	**1.3**	0.043 U	0.22 U
Benzo(b)fluoranthene	1	**1.1**	**1.5**	**0.055**	0.22 U
Benzo(a)pyrene	1	**0.86**	**1.4**	0.043 U	0.22 U
Indeno(1,2,3-cd)pyrene	0.5	**0.61 J**	**1.2 J**	0.043 U	0.22 U
Total PAHs	NE	**10.638**	**16.58**	**0.055**	**46.1**
Other SVOCs (mg/kg)					
Total SVOCs	NE	**10.638**	**16.58**	**0.055**	**46.1**

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010
NO EXCEEDANCES			

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013
NO EXCEEDANCES			

Sample Name: / Sample Depth (feet): / Sample Date:	RESTRICTED USE SCO - RESTRICTED RESIDENTIAL	SSGP-09 (3.0-3.4) 6/25/2013	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013
NO EXCEEDANCES				

LEGEND:

SITE BOUNDARY(APPROXIMATE)

HISTORICAL GAS HOLDER

SSGP-06 GEOPROBE® BORING

6 NYCRR -New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

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mg/kg	milligrams/kilogram or parts per million (ppm)
ft bgs	feet below ground surface
BTEX	benzene, toluene, ethlybenzene, and xylene
PAHs	polycyclic aromatic hydrocarbons
VOCs	volatile organic compounds
SVOCs	semi-volatile organic compounds
NE	not established
ND	not detected; total concentration is listed as ND because no compounds were detected in the group
U	indicates not detected at or above the reporting limit shown
J	estimated value
BOLD	indicates a detected concentration
BOLD	indicates that the detected result value exceeds established 6 NYCRR SCO RESTRICTED USE RESTRICTED RESIDENTIAL

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11 AND 6/23/11. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.

0 100' 200'

SCALE: 1" = 100'

Interim Site Management Plan
Former Skillman Street Holder Station
Brooklyn, New York

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LOCATION OF SOIL CONTAMINATION ABOVE SITE-SPECIFIC ACTION LEVELS (mg/kg)

Project 093080 | March 2017 | Fig. 14

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Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-06 (11-16) 8/25/2010
BTEX (Õg/L)		
Toluene	5	**1100**
Ethylbenzene	5	**930**
Total Xylene	5	**3900**
Total BTEX	NE	**5930**
Other VOCs (Õg/L)		
Styrene	5	**1800**
Total VOCs	NE	**7730**
PAHs (Õg/L)		
Naphthalene	10*	**3300**
Total PAHs	NE	**3400**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**3400**
Total Metals (Õg/L)		
Iron	300	**6840**
Manganese	300	**5830**
Sodium	20000	**99900**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-06 (25-30) 5/31/2011
BTEX (Õg/L)		
Benzene	1	**410**
Toluene	5	**600**
Ethylbenzene	5	**720**
Total Xylene	5	**1700**
Total BTEX	NE	**3430**
Other VOCs (Õg/L)		
cis-1,2-Dichloroethene	5	**600**
Styrene	5	**92**
Vinyl chloride	2	**290**
Total VOCs	NE	**4412**
PAHs (Õg/L)		
Naphthalene	10*	**1200**
Total PAHs	NE	**1214**
Other SVOCs (Õg/L)		
2-Methylphenol (o-Cresol)	1	**21 J**
Total SVOCs	NE	**1235**
Total Metals (Õg/L)		
Manganese	300	**3460**
Sodium	20000	**109000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-08 (7-17) 9/9/2011
BTEX (ug/L)		
Total BTEX	NE	ND
Other VOCs (ug/L)		
Total VOCs	NE	17.4
PAHs (ug/L)		
Total PAHs	NE	ND
Other SVOCs (ug/L)		
Phenol	1	**1.4**
Total SVOCs	NE	1.4

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-02 (11-21) 5/31/2011
BTEX (Õg/L)		
Benzene	1	**100 J**
Toluene	5	**260**
Ethylbenzene	5	**250**
Total Xylene	5	**800**
Total BTEX	NE	**1410**
Other VOCs (Õg/L)		
Acetone	50*	**850**
cis-1,2-Dichloroethene	5	**8000**
trans-1,2-Dichloroethene	5	**39 J**
Styrene	5	**360**
Tetrachloroethene (PCE)	5	**9400**
Trichloroethene (TCE)	5	**1900**
Vinyl chloride	2	**380**
Total VOCs	NE	**22339**
PAHs (Õg/L)		
Naphthalene	10*	**490**
Total PAHs	NE	**500**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**500**
Total Metals (Õg/L)		
Iron	300	**26400**
Manganese	300	**7070**
Sodium	20000	**114000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-05 (8-18) 8/9/2010
BTEX (Õg/L)		
Total BTEX	NE	ND
Other VOCs (Õg/L)		
Total VOCs	NE	ND
PAHs (Õg/L)		
Total PAHs	NE	ND
Other SVOCs (Õg/L)		
Total SVOCs	NE	**1**
Total Metals (Õg/L)		
Iron	300	**10100**
Manganese	300	**2780**
Sodium	20000	**59800**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-07 (7-17) 9/9/2011
BTEX (ug/L)		
Total BTEX	NE	ND
Other VOCs (ug/L)		
Total VOCs	NE	2.12
PAHs (ug/L)		
Total PAHs	NE	ND
Other SVOCs (ug/L)		
Total SVOCs	NE	0.62

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-03 (12-22) 5/31/2011
BTEX (Õg/L)		
Total BTEX	NE	**4.36**
Other VOCs (Õg/L)		
Total VOCs	NE	**9.06**
PAHs (Õg/L)		
Total PAHs	NE	**5.6**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**6.22**
Total Metals (Õg/L)		
Iron	300	**3720**
Manganese	300	**965**
Sodium	20000	**197000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-02 (13-23) 6/28/2013
BTEX (Õg/L)		
Benzene	1	**240**
Toluene	5	**79**
Ethylbenzene	5	**32**
o-Xylene	5	**150**
m/p-Xylene	5	**100**
Total BTEX	NE	**601**
Other VOCs (Õg/L)		
cis-1,2-Dichloroethene	5	**1900**
Isopropyl benzene	5	**64**
Tetrachloroethene (PCE)	5	**230**
Trichloroethene (TCE)	5	**140**
Vinyl chloride	2	**200**
Total VOCs	NE	**3135**
PAHs (Õg/L)		
Naphthalene	10*	**62**
Total PAHs	NE	**62**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**62**
Total Metals (Õg/L)		
Chromium	50	**68**
Iron	300	**50000**
Lead	25	**75**
Manganese	300	**2700**
Sodium	20000	**83000**
Total Cyanide (Õg/L)		
Total Cyanide	200	**330 J**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-04 (10-20) 6/1/2011
BTEX (Õg/L)		
Total BTEX	NE	ND
Other VOCs (Õg/L)		
Tetrachloroethene (PCE)	5	**12**
Total VOCs	NE	**14.22**
PAHs (Õg/L)		
Total PAHs	NE	ND
Other SVOCs (Õg/L)		
Total SVOCs	NE	**0.85**
Total Metals (Õg/L)		
Antimony	3	**5.1 J**
Iron	300	**15100**
Magnesium	35000*	**188000**
Manganese	300	**1590**
Selenium	10	**20.3 J**
Sodium	20000	**87500**
Thallium	0.5*	**4 J**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-01 (11.5-21.5) 6/27/2013	Duplicate of: SSGW-01 (11.5-21.5) 6/27/2013
BTEX (Õg/L)			
Benzene	1	**4300**	**5600**
Toluene	5	**16000**	**20000**
Ethylbenzene	5	**9500**	**12000**
o-Xylene	5	**4000**	**4900**
m/p-Xylene	5	**7700**	**9400**
Total BTEX	NE	**41500**	**51900**
Other VOCs (Õg/L)			
Isopropyl benzene	5	**350**	**420**
Styrene	5	**70 J**	**82**
Total VOCs	NE	**41920**	**52402**
PAHs (Õg/L)			
Naphthalene	10*	**5600 J**	**3300 J**
Total PAHs	NE	**5600**	**3500**
Other SVOCs (Õg/L)			
Total SVOCs	NE	**5600**	**3500**
Total Metals (Õg/L)			
Iron	300	**20000**	**26000**
Lead	25	**83 J**	**280 J**
Manganese	300	**690 J**	**1300 J**
Sodium	20000	**100000**	**110000**
Total Cyanide (Õg/L)			
Total Cyanide	200	**240 J**	**200 J**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-05 (11-21) 6/1/2011	Duplicate of SSMW-05 (11-21) 6/1/2011
BTEX (Õg/L)			
Total BTEX	NE	ND	ND
Other VOCs (Õg/L)			
1,2-Dichloroethane	0.6	**4.3 J**	**4.1 J**
Tetrachloroethene	5	**5.6**	5 U
Total VOCs	NE	**9.9**	**4.1**
PAHs (Õg/L)			
Total PAHs	NE	ND	ND
Other SVOCs (Õg/L)			
Total SVOCs	NE	**1.11**	**1.06**
Total Metals (Õg/L)			
Manganese	300	**7440**	**7540**
Sodium	20000	**293000**	**276000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-03 (15-25) 6/26/2013
BTEX (Õg/L)		
Benzene	1	**13**
Total BTEX	NE	**13**
Other VOCs (Õg/L)		
cis-1,2-Dichloroethene	5	**9.2**
Total VOCs	NE	**22.2**
PAHs (Õg/L)		
Total PAHs	NE	**ND**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**ND**
Total Metals (Õg/L)		
Chromium	50	**380**
Copper	200	**390**
Iron	300	**410000**
Lead	25	**170**
Magnesium	35000*	**150000**
Manganese	300	**30000**
Nickel	100	**280**
Sodium	20000	**140000**

LEGEND:

	SITE BOUNDARY(APPROXIMATE)
	HISTORICAL GAS HOLDER
SSMW-02	MONITORING WELL
SSGW-05	TEMPORARY GROUNDWATER SAMPLING POINT
7.5	GROUNDWATER CONTOUR (FEET NAVD)
	INFERRED GROUNDWATER FLOW DIRECTION
NAVD	NORTH AMERICAN VERTICAL DATUM

NYS AWQS - New York State Ambient Water Quality Standards and Guidance Values for GA groundwater

NE	not established
ND	not detected
J	estimated value
U	indicates not detected to the reporting limit for organic analysis and the method detection limit for inorganic analysis
*	indicates the value is a guidance value and not a standard
BOLD	indicates detected concentration
BOLD	indicates that the detected concentration is above the NYS AWQS objective it was compared to
Õg/L	micrograms per liter or parts per billion (ppb)
BTEX	benzene, toluene, ethylbenzene, and xylene
PAHs	polycyclic aromatic hydrocarbons
VOCs	volatile organic compounds
SVOCs	semi-volatile organic compounds

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
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0 60' 120'
SCALE: 1" = 60'

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GROUNDWATER ANALYTICAL SUMMARY (µg/L)

March 2017

Fig. 15

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LEGEND:

SITE BOUNDARY(APPROXIMATE)

CONCRETE BUILDING FOUNDATION

SOURCES:

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0 80' 160'

SCALE: 1" = 80'

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LOCATION OF ENGINEERING CONTROLS

Project 093080 | March 2017 | Fig. 16

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0 0.5 1 2

SCALE: 1" = 1 MILE

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TRUCK TRANSPORT ROUTES

Project 093080 | March 2017 | Fig. 17

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Appendix A

Environmental Easement

Appendix B

Excavation Work Plan (EWP)

Excavation Work Plan (EWP)

The March 31, 2015 ROD requires an EWP that details the provisions for management of limited excavations in areas of impacts. Since the final remedy, if any, has not yet been completed, this EWP will be implemented to address any intrusive activities prior to the final remedy or any portion of the final remedy at the Site. The property owner is required to implement this EWP. National Grid is only responsible for costs associated with MGP-related impacts.

B-1 NOTIFICATION

At least 60 days prior to the start of any limited excavation activity that is anticipated to encounter impacts, the property owner or their representative will notify the NYSDEC and National Grid. Table B-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix C.

Table B-1: Notifications*

R. Scott Deyette, NYSDEC Project Manager	(518) 402-9662 scott.deyette@dec.ny.gov
Paul John, NYSDEC Regional HW Engineer	(718) 482-4931 paul.john@dec.ny.gov
Kelly Lewandowski, Chief, NYSDEC Site Control	(518) 402-9569 kelly.lewandowski@dec.ny.gov
Donald Campbell, National Grid Project Manager	(718) 963-5453 donald.campbell@nationalgrid.com

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

All intrusive activities must be approved by NYSDEC. Notification must be made to NYSDEC in accordance with Section 1.3 of the ISMP.

National Grid will generate the notification to NYSDEC via a notice of intrusion letter. This notification will include:

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

- Whether proposed activities will require dewatering, proposed containment of dewatering liquids and planned disposal options for dewatering liquids;

- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;

- A schedule for the work, detailing the start and completion of all intrusive work;

- A summary of the applicable components of this EWP;

- A statement that the work will be performed in compliance with this EWP and 29 Code of Federal Regulation (CFR) 1910.120;

- A copy of the contractor's HASP, in electronic format, if it differs from the HASP provided in Appendix G of this ISMP;

- Identification of disposal facilities for potential waste streams; and

- Identification of sources of any anticipated backfill, along with all required chemical testing results.

B-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a QEP or person under their supervision during all limited excavations into known or potentially contaminated impacted material. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work.

Based on previous environmental data and screening results, soils will be segregated into material that requires off-site disposal and material that requires testing to determine if the material can be reused as soil beneath a cover. Further discussion of off-site disposal of materials and on-site reuse is provided in Sections B-5 and B-6 of this Appendix.

B-3 SOIL STAGING METHODS

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters, and other discharge points. Stockpiles will be located and sized to minimize potential for material or run-off to enter discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced. Stockpiles will be segregated on-site based on the soil/material type. These soil/material types will include impacted soils, reuse soil, and imported fill.

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

B-4 MATERIALS EXCAVATION AND LOAD-OUT

A QEP or person under their supervision will oversee all invasive work and the excavation at the Site and load-out of all excavated material. This includes any invasive work performed within the holder footprint extending onto the 744 Bedford Avenue property.

To the extent they perform work under this EWP, the property owner(s) and their contractor(s) are responsible for safe execution of all invasive and other work including the structural integrity of excavations and structures, such as subsurface utilities and buildings, that may be affected by excavations.

The presence of utilities and easements on the Site will be investigated. Based on this investigation, it will be determined whether a risk or impediment to the work planned under this EWP is posed by utilities or easements on the Site.

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

A truck wash will be operated on-Site, as appropriate. The QEP will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site, until the activities performed under this section are complete. Truck wash waters will be collected and disposed off-site in an appropriate manner.

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

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

B-5 MATERIALS TRANSPORT OFF-SITE

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

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

The NYSDOT-approved truck transport routes are included in Figure 17. All trucks loaded with site materials will exit the vicinity of the Site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; (f) overall safety in transport; and (g) community input.

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

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

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

B-6 MATERIALS DISPOSAL OFF-SITE

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

Regulated soils will be stockpiled and transported to a National Grid approved facility. Off-site disposal locations for excavated soils will be identified in the pre-excavation notification prepared by the owner and provided to National Grid for review and submittal to NYSDEC. This will include estimated quantities and a breakdown by class of disposal facility if appropriate. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the PRR. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

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

B-7 MATERIALS REUSE ON-SITE

Material that meets the Restricted Residential Use SCOs listed in Table 375-6.8(b) of 6 NYCRR Part 375 meet the chemical criteria for on-Site reuse. Prior to reuse, samples will be collected and analyzed by an Environmental Laboratory Approval Program (ELAP)-certified laboratory for:

- Total VOCs via U.S. Environmental Protection Agency (EPA) Method 8260
- Total SVOCs via EPA Method 8270C
- Polychlorinated biphenyls (PCBs) via EPA Method 8082/8082A/8080
- Total Petroleum Hydrocarbons (TPH) Diesel Range Organics/Gasoline Range Organics (DRO/GRO) via EPA Method 8015M (expanded to C44)
- Total cyanide via EPA Method 9010/9014
- Total Metals (RCRA+Cu, Ni, Zn, Va,Cn HexChrome) via EPA Method 6010B and 6010
- TCLP Metals via EPA Method 1311
- Ignitabilty via EPA Method 1030 and 1010A
- Corrosivity via EPA Method 1030 and 9040C
- Reactivity via EPA Method 1110 and SW846 Ch7.5
- Total Sulfur via American Society for Testing and Materials (ASTM) Standard D129
- TCLP Volatile Organics via EPA Method 8260B
- TCLP Semi-volatile Organics via EPA Method 8270D
- TCLP Herbicides/TCLP Pesticides via EPA Method 1311
- Total Organic Halides via EPA Method 9023B
- Total Mercury via EPA Method 7471.

The QEP will ensure that procedures defined for materials reuse in this EWP are followed and that unacceptable material does not remain on-site. Impacted soil that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

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

B-8 FLUIDS MANAGEMENT

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

Discharge of water generated during limited intrusive activities to surface waters (i.e. a local pond, stream or river) will be performed under a State Pollutant Discharge Elimination System (SPDES) permit.

B-9 COVER SYSTEM RESTORATION

A site cover currently exists (building or former building foundation slab) at the Site and will be maintained by the property owners to allow for the current commercial use of the property.

Any property redevelopment will also maintain a site cover, which may consist either of structures such as buildings, pavement and sidewalks comprising the property redevelopment, or a soil cover in areas where the upper 2 feet of exposed soil would otherwise exceed the applicable soil cleanup objectives (SCOs). Where a soil cover is required it will be a minimum of 2 feet of soil, meeting the SCOs for cover material as set forth in 6 NYCRR Part 375-6.7(d) for restricted residential use. The soil cover will be placed over a demarcation layer, consisting of a high visibility woven geotextile or equivalent material, with the upper 6 inches of the soil cover being of sufficient quality to maintain a vegetation layer. The demarcation barrier will provide a visual reference to the top of the zone that requires adherence to this EWP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the existing soils. A figure showing the modified surface will be included in the subsequent PRR and in an updated ISMP.

B-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by National Grid's QEP and will be in compliance with provisions in this EWP prior to receipt at the Site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared by the owner and submitted to the NYSDEC project manager by National Grid allowing a minimum of five business days for review. This will include analytical sampling of the borrow source or existing documentation of agency approvals of the source (i.e. NYSDOT virgin source certification and latest analytical sampling results). NYSDEC approval must be received before material is imported to the Site.

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

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Based on an evaluation of the land use, protection of groundwater, and protection of ecological resources criteria, the resulting soil quality standards are the Restricted Residential Use SCOs listed in Table 375-6.8(a) of 6 NYCRR Part 375. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for the Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

Samples will be collected from imported fill in accordance with the analytical sampling requirements of DER-10 and the frequency requirements in NYSDEC's Soil Cleanup Guidance, CP-51. At a minimum, samples will be analyzed for Inorganics, Pesticides, PCBs, VOCs and SVOCs in accordance with the analytes for the Restricted Residential Use SCOs listed in Table 375-6.8(a) of 6 NYCRR Part 375. The frequency and type of the sampling (i.e. discrete or composite) will be based on the quantity of material imported in accordance with Table 4 of CP-51.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases (Section B-3).

B-11 STORMWATER POLLUTION PREVENTION

For excavations less than 1 acre that are not part of a larger disturbance, the following stormwater management practices will be completed in accordance with the requirements in the New York State Stormwater Management Design Manual, latest revision.

Silt fencing and/or hay bale checks will be installed around the entire perimeter of the construction area and will be inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

Accumulated sediments will be removed as required to keep the silt fencing and/or hay bale check functional.

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

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

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

In the event that the work on the property is part of a larger plan that disturbs more than 1 acre, the respective property owner must obtain coverage under the NYSDEC SPDES General Permit for Stormwater Discharges from Construction Activity.

B-12 EXCAVATION CONTINGENCY PLAN

Identification of unknown or unexpected potentially-impacted media identified by screening during invasive site work will be promptly communicated by phone to National Grid, and National Grid will notify the NYSDEC’s Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

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

In the event that potential impacts are encountered at unexpected depth or locations, Site activities will be suspended and National Grid will be notified and will evaluate the observed conditions in a manner and timeframe that does not interfere with the property owner’s(s’) limited excavation schedule, to the extent reasonably feasible. National Grid may determine that laboratory testing is required to evaluate the observed conditions for concentrations and characteristics. If the encountered materials are determined to be MGP impacted, then the encountered materials will be segregated and stockpiled for disposal at a National Grid approved facility.

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; Target Compound List (TCL) volatiles and semi-volatiles, TCL pesticides and PCBs; and free cyanide). In the event that future sampling results provide a sufficient justification to limit the list of analytes, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

B-13 COMMUNITY AIR MONITORING PLAN

The CAMP will consist of a real time monitoring and action level reporting system. The CAMP will be conducted during all intrusive activity on the Site. Air sampling station locations will be chosen based on general prevailing wind conditions and adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations. A fixed monitoring location will be located adjacent to the school on Skillman Street regardless of wind direction.

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

B-14 ODOR CONTROL PLAN

Odors which derive from site contaminants may cause a nuisance to some site workers and the surrounding community, even though the contaminants are at levels well below the safety limits defined in the CAMP. This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include all reasonable and necessary means as described in the following paragraph. If nuisance odors are identified at the Site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified by National Grid of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the contractor, and any measures that are implemented will be discussed in the Periodic Review Report.

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

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

B-15 DUST CONTROL PLAN

Dust which derives from site contaminants may cause a nuisance to some site workers and the surrounding community, even though the contaminants are at levels well below the safety limits defined in the CAMP. A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, un-vegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

In the event that complaints are received for dust, the contractor will take the appropriate response actions for dust suppression.

Appendix C

List of Site Contacts

List of Site Contacts

Name	Phone/Email Address
7 Skillman Street: Bedford Flushing Holding Corp. c/o Mendel Roth 760 Bedford Avenue Brooklyn, NY 11205	(718) 858-4277 theedenpalace@gmail.com
744 Bedford Avenue : Bedford EMR Holdings, LLC c/o Mendel Roth 760 Bedford Avenue Brooklyn, NY 11205	(718) 858-4277 theedenpalace@gmail.com
Donald Campbell National Grid Project Manager	(718) 963-5453 donald.campbell@nationalgrid.com
Melissa Felter GEI Consultants Project Manager	(860) 368-5328 mfelter@geiconsultants.com
Matt O'Neil, PE GEI Consultants Project Engineer	(401) 533-5152 moneil@geiconsultants.com
R. Scott Deyette NYSDEC Project Manager	(518) 402-9662 scott.deyette@dec.ny.gov
Paul John NYSDEC Regional HW Engineer	(718) 482-4931 paul.john@ dec.ny.gov
Kelly Lewandowski Chief, NYSDEC Site Control	(518) 402-9569 kelly.lewandowski@ dec.ny.gov
Francis J. Murphy Senior Counsel National Grid	(516) 545-3745 francis.murphy@nationalgrid.com

Appendix D

NYSDEC Correspondence (Electronic Only)

Donald P. Campbell
Lead Engineer
Site Investigation and Remediation

nationalgrid

April 22, 2016

Mr. Mendal Roth
Bedford Roth Holding LLC
760 Bedford Avenue
Brooklyn, NY 11205

Re: Skillman Street Holder Station Site
Brooklyn, Kings County, New York
Site No. 224068
Redevelopment Associated with Brownfield Cleanup Program Site No. C224193

Dear Mr. Roth:

The Brooklyn Union Gas Company, formerly d/b/a KeySpan Energy Delivery New York, and now d/b/a National Grid NY, entered into an Order on Consent and Administrative Settlement, Index #A2-0552-0606, dated February 22, 2007, with the New York State Department of Environmental Conservation (NYSDEC, or the Department) to evaluate environmental conditions at a number of sites, including the Skillman Street Holder Station Site (the Site), which is currently designated a Class A site. The majority of the Site is located on the real property at 7 Skillman Street but includes a 10 ft x 90 ft rectangular swath (the Bedford Strip) located within the real property at 744 Bedford Avenue, adjacent to 7 Skillman Street. The real property at the addresses 742 – 760 Bedford Avenue are included in an NYSDEC Brownfield Cleanup Program (BCP) site identified as 744 Bedford Avenue, site #C224193, for which Bedford Roth Holding LLC is the Volunteer and property owner.

National Grid has completed a site characterization (SC) for the Site, and the results are described in the final site characterization (SC) report dated March 2014 (the March 2014 SC Report). In March 2015, NYSDEC issued a Record of Decision that included a requirement for a Site Management Plan (SMP). A draft Interim SMP (ISMP) has been submitted to NYSDEC and comments have been received. National Grid anticipates that the final ISMP will be submitted to NYSDEC in May 2016.

In March 2016, National Grid performed a Pre-Design Investigation (PDI) of the Bedford Strip, and a report is currently being drafted on the findings of the PDI. On April 20, 2016, National Grid met with NYSDEC to discuss the findings of the PDI. While the draft report is scheduled for submittal to NYSDEC in May 2016, at this time, I am writing to you, the representative of the BCP Applicant and of the owner of the real property at 744 Bedford Avenue, (1) to transmit data generated during the PDI and (2) to inform you of the environmental requirements associated with working on the Site as part of the upcoming redevelopment under BCP Site No. C224193. Attachment 1 contains the following data that was generated during the March 2016 field work at the Site:

287 Maspeth Avenue, Brooklyn, NY 11211
T: 718.963.5453 F: 718.963.7890 donald.campbell@nationalgrid.com www.nationalgrid.com

- validated soil and groundwater sample laboratory analytical results;
- un-validated waste characterization data
- draft sample location figure
- draft boring and test pit logs; and
- draft cross sections.

The March 2014 SC Report has been transmitted previously to Environmental Business Consultants (EBC), on information and belief that EBC is supporting the redevelopment associated with BCP Site No. C224193. For convenience, Figures 6 and 7 from the March 2014 SC Report are included in Attachment 2 of this letter.

Based on the March 2014 SC report and the results of the March 2016 PDI, the former holder No. 1 tank wall and foundation extend into the Bedford Strip from the 7 Skillman Street property, and the former holder No. 1 tank appears to be intact underneath the building located on the 7 Skillman Street property. Soil and perched groundwater inside the holder tank is impacted with sheen. In addition, BTEX and PAHs exceed Unrestricted SCOs in soils from 3-4 feet and 20-22 feet below grade and AWQSs in groundwater inside the former holder No 1 tank. The soil located on the Bedford Strip and outside of the former holder tank wall is not material that would require remediation under current regulations. Odors and occasional staining are present in the soil outside of the holder tank wall, and thus the soil will have to be managed accordingly.

Source material, as defined by the NYSDEC, and which requires remediation, is not present on the Bedford Strip. Source material is defined by the NYSDEC as:

1. Grossly contaminated soil, as defined in 6 NYCRR Part 375-1.2(u);
2. Soil exceeding 6 NYCRR Part 371 and USEPA hazardous criterion for lead;
3. Areas of concentrated solid or semi-solid hazardous substances;
4. Non-Aqueous Phase Liquids (NAPL);
5. Soil containing visual coal tar or Light Non-Aqueous Phase Liquid (LNAPL) or Dense Non-Aqueous Phase Liquid (DNAPL); and
6. Soil containing Semi-volatile Organic Compounds (SVOCs) exceeding 500 ppm.

Although there is no source material present on the Bedford Strip, construction that would result in the release of the perched groundwater inside the former Holder No. 1 tank would represent a significant environmental concern and a potential release condition. If the construction plans for the redevelopment involve excavation and removal of a portion of the former holder No. 1 tank wall, the following environmental concerns related to the perched groundwater within the holder No. 1 foundation must be addressed during design and construction.

- The potential for a release of the impacted water contained with the former holder No. 1 tank.
- Removal of all perched water from the holder (to a depth below the depth of the water table outside of the holder) prior to construction may result in changes to the hydrostatic pressure gradient across the former holder No. 1 tank wall, resulting in damage to the tank wall. Such damage may create communication between the perched water within the former holder No. 1 tank and the local groundwater, which would in turn lead to future releases of impacted water from the former holder No. 1 tank.

- Complete removal of the former holder No. 1 tank wall and the foundation of the holder on and in the area of the Bedford Strip will result in creating direct communication of impacted perched groundwater and soil within the holder foundation and the local groundwater. This condition will create a continued source of groundwater contamination at the Site.

Odors were contained within the urban fill material and soil observed on the Bedford Strip. Excavation of the urban fill material and soil may release contained odors which may result in nuisance odors and community complaints during construction activities. It is possible that the urban fill material on the remainder of the 744 Bedford Avenue property will have similar odors upon excavation. The NYSDOH CAMP requirements in Appendix 1A of DER-10 are established as a minimum standard for all remedial programs, including the BCP program. In accordance with the NYSDOH Generic CAMP, specific requirements should be reviewed in consultation with NYSDOH and include "*common-sense measures to keep VOCs, dust, and odors at a minimum around work areas*." Given the odors observed in the urban fill materials and soil, consultation with NYSDOH would be required to develop an odor control plan in accordance with Section 5.1 (f) 4.iii of DER-10. The odor control plan should "i*dentify the measures to be undertaken during the remedial action to monitor, prevent or control the generation of vapor or odors during the remedial action."* This should include "*triggers which will require action to mitigate vapor/odors or which may trigger the need for alternative construction methods or shut down of the operation resulting in the odors or vapors*."

Work on the Bedford Strip must be completed in accordance with the IS MP prepared for the former MGP Site. Excavation work must be in accordance with the NYSDEC-approved Excavation Work Plan that will be included with the ISMP. This includes addressing the requirements and restrictions for dewatering and disposal of impacted groundwater.

Finally, I would also like to inform you of the requirement that the Department must be notified at least sixty (60) days in advance of any change in site use at the Bedford Strip. The change of use notification is specified in 6 NYCRR Part 375-1.11(d), and defined in Part 375-2.2(a). This requirement is also described in Section 1.3 of the NYSDEC SMP template. The NYSDEC project manager for the Skillman Street Holder Station Site is Mr. R. Scott Deyette. Contact information for Mr. Deyette follows.

R. Scott Deyette
Chief, Inspection Unit
Division of Environmental Remediation
Remedial Bureau C
625 Broadway
Albany, NY 12233-7014
Email: scott.deyette@dec.ny.gov
Phone: (518) 402-9662

Sincerely,

Donald P. Campbell

Donald P. Campbell
Project Manager

ec:	R. Deyette	NYSDEC
	G. Heitzman	NYSDEC
	S. Malsan	NYSDEC
	D. Tuohy	NYSDEC
	B. Boyd	NYSDOH
	T. Leissing	National Grid
	F. Murphy	National Grid
	L. Schnapf	Schnapf
	J. Brooks	Philips Nizer
	A. Ahles	GEI
	M. Felter	GEI
	M. O'Neil	GEI

ATTACHMENT 1

Table 1. Subsurface Soil Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

				Location Name	SSSB-19	SSSB-19	SSSB-19	SSSB-19	SSSB-20	SSSB-20	SSSB-21
				Sample Name	SSSB-19(7.5-8.5)	SSSB-DUP-01	SSSB-19(13.5-15)	SSSB-19(33-34)	SSSB-20(23.5-24)	SSSB-20(33-34)	SSSB-21(21.5-22)
				Start Depth	7.5	7.5	13.5	33	23.5	33	21.5
				End Depth	8.5	8.5	15	34	24	34	22
				Depth Unit	ft	ft	ft	ft	ft	ft	ft
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/9/2016
				Parent Sample		SSSB-19(7.5-8.5)					
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**							
BTEX	mg/kg										
Benzene		71-43-2	0.06	2.9	0.00087 U	**0.0024**	0.00075 U	**0.016**	**0.0025**	**0.096**	**0.002**
Toluene		108-88-3	0.7	100	0.00087 U	0.001 U	0.00075 U	**0.0016**	**0.0013**	**0.076**	0.0007 U
Ethylbenzene		100-41-4	1	30	0.00087 U	0.001 U	0.00075 U	**0.19**	0.00077 U	**0.48**	0.0007 U
o-Xylene		95-47-6	0.26	100	0.00087 U	0.001 U	0.00075 U	**0.017**	0.00077 U	**0.16**	0.0007 U
m/p-Xylene		179601-23-1	0.26	100	0.00087 U	0.001 U	0.00075 U	**0.01**	0.00077 U	**0.33**	0.0007 U
Total BTEX (ND=0)		TBTEX_ND0	NE	NE	ND	**0.0024**	ND	**0.2346**	**0.0038**	**1.142**	**0.002**
Other VOCs	mg/kg										
Acetone		67-64-1	0.05	100	0.0043 U	0.005 U	0.056 U	0.0035 U	0.015 U	0.19 U	0.0068 U
Bromochloromethane		74-97-5	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Bromodichloromethane		75-27-4	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Bromoform		75-25-2	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Bromomethane		74-83-9	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Carbon disulfide		75-15-0	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	**0.0014**	0.038 U	0.0007 U
Carbon tetrachloride		56-23-5	0.76	1.4	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Chlorobenzene		108-90-7	1.1	100	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Chloroethane		75-00-3	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 UJ	0.038 U	0.0007 U
Chloroform		67-66-3	0.37	10	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Chloromethane		74-87-3	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Cyclohexane		110-82-7	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,2-Dibromo-3-chloropropane		96-12-8	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Dibromochloromethane		124-48-1	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,2-Dibromoethane (EDB)		106-93-4	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,2-Dichlorobenzene		95-50-1	1.1	100	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,3-Dichlorobenzene		541-73-1	2.4	17	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,4-Dichlorobenzene		106-46-7	1.8	9.8	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Dichlorodifluoromethane (Freon 12)		75-71-8	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,1-Dichloroethane		75-34-3	0.27	19	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,2-Dichloroethane		107-06-2	0.02	2.3	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,1-Dichloroethene		75-35-4	0.33	100	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
cis-1,2-Dichloroethene		156-59-2	0.25	59	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
trans-1,2-Dichloroethene		156-60-5	0.19	100	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,2-Dichloropropane		78-87-5	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
cis-1,3-Dichloropropene		10061-01-5	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
trans-1,3-Dichloropropene		10061-02-6	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,4-Dioxane		123-91-1	0.1	9.8	0.017 U	0.02 U	0.015 U	0.014 U	0.015 U	0.94 U	0.014 U

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National Grid
Brooklyn, New York

				Location Name	SSSB-19	SSSB-19	SSSB-19	SSSB-19	SSSB-20	SSSB-20	SSSB-21
				Sample Name	SSSB-19(7.5-8.5)	SSSB-DUP-01	SSSB-19(13.5-15)	SSSB-19(33-34)	SSSB-20(23.5-24)	SSSB-20(33-34)	SSSB-21(21.5-22)
				Start Depth	7.5	7.5	13.5	33	23.5	33	21.5
				End Depth	8.5	8.5	15	34	24	34	22
				Depth Unit	ft	ft	ft	ft	ft	ft	ft
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/9/2016
				Parent Sample		SSSB-19(7.5-8.5)					
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**							
2-Hexanone		591-78-6	NE	NE	0.0043 U	0.005 U	0.0038 U	0.0035 U	0.0039 U	0.19 U	0.0035 U
Isopropylbenzene		98-82-8	NE	NE	0.00087 U	0.001 U	0.00075 U	**0.019**	0.00077 U	**0.058**	0.0007 U
Methyl acetate		79-20-9	NE	NE	0.0043 U	0.005 U	0.0038 U	0.0035 U	0.0039 U	0.19 U	0.0035 U
Methyl ethyl ketone (2-Butanone)		78-93-3	0.12	100	0.0043 U	0.005 U	0.0038 U	0.0035 U	0.0039 U	0.19 U	0.0035 U
Methyl tert-butyl ether (MTBE)		1634-04-4	0.93	62	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 UJ	0.0007 U
4-Methyl-2-pentanone (MIBK)		108-10-1	NE	NE	0.0043 U	0.005 U	0.0038 U	0.0035 U	0.0039 U	0.19 U	0.0035 U
Methylcyclohexane		108-87-2	NE	NE	0.00087 U	0.001 U	0.00075 U	**0.0012**	**0.00095**	0.038 U	0.0007 U
Methylene chloride		75-09-2	0.05	51	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Styrene		100-42-5	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	**0.00088**	0.038 U	**0.001**
1,1,2,2-Tetrachloroethane		79-34-5	NE	NE	0.00087 UJ	0.001 UJ	0.00075 UJ	0.00071 UJ	0.00077 U	0.038 U	0.0007 U
Tetrachloroethene (PCE)		127-18-4	1.3	5.5	**0.0011**	**0.001**	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		76-13-1	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,2,3-Trichlorobenzene		87-61-6	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 UJ	0.0007 U
1,2,4-Trichlorobenzene		120-82-1	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,1,1-Trichloroethane (TCA)		71-55-6	0.68	100	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
1,1,2-Trichloroethane		79-00-5	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Trichloroethene (TCE)		79-01-6	0.47	10	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Trichlorofluoromethane (Freon 11)		75-69-4	NE	NE	0.00087 U	0.001 U	0.00075 U	0.00071 U	0.00077 U	0.038 U	0.0007 U
Vinyl chloride		75-01-4	0.02	0.21	0.00087 UJ	0.001 UJ	0.00075 UJ	0.00071 UJ	0.00077 U	0.038 U	0.0007 U
Total VOCs (ND=0)		TVOC_ND0	NE	NE	**0.0011**	**0.0034**	ND	**0.2548**	**0.00703**	**1.2**	**0.003**
NYSDEC PAH17	mg/kg										
Acenaphthene		83-32-9	20	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Acenaphthylene		208-96-8	100	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Anthracene		120-12-7	100	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(a)anthracene		56-55-3	1	1	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(b)fluoranthene		205-99-2	1	1	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(k)fluoranthene		207-08-9	0.8	1	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(g,h,i)perylene		191-24-2	100	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzo(a)pyrene		50-32-8	1	1	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Chrysene		218-01-9	1	1	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Dibenz(a,h)anthracene		53-70-3	0.33	0.33	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Fluoranthene		206-44-0	100	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Fluorene		86-73-7	30	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2-Methylnaphthalene		91-57-6	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Naphthalene		91-20-3	12	100	0.99 U	0.22 U	0.19 U	**0.69**	0.19 U	**1.2**	0.19 U

				Location Name	SSSB-19	SSSB-19	SSSB-19	SSSB-19	SSSB-20	SSSB-20	SSSB-21
				Sample Name	SSSB-19(7.5-8.5)	SSSB-DUP-01	SSSB-19(13.5-15)	SSSB-19(33-34)	SSSB-20(23.5-24)	SSSB-20(33-34)	SSSB-21(21.5-22)
				Start Depth	7.5	7.5	13.5	33	23.5	33	21.5
				End Depth	8.5	8.5	15	34	24	34	22
				Depth Unit	ft	ft	ft	ft	ft	ft	ft
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/9/2016
				Parent Sample		SSSB-19(7.5-8.5)					
Analyte	Units	CAS No.	Unrestricted SCO	Residential SCO							
Phenanthrene		85-01-8	100	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Pyrene		129-00-0	100	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	ND	ND	ND	**0.69**	ND	**1.2**	ND
NYSDEC PAH17 Other SVOCs	mg/kg										
Acetophenone		98-86-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Atrazine		1912-24-9	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Benzaldehyde		100-52-7	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Bis(2-chloroethoxy)methane		111-91-1	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Bis(2-chloroethyl)ether		111-44-4	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2,2-oxybis(1-Chloropropane)		108-60-1	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4-Bromophenyl phenyl ether		101-55-3	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Butyl benzyl phthalate		85-68-7	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Caprolactam		105-60-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Carbazole		86-74-8	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4-Chloro-3-methylphenol		59-50-7	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4-Chloroaniline		106-47-8	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2-Chloronaphthalene		91-58-7	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2-Chlorophenol		95-57-8	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4-Chlorophenyl phenyl ether		7005-72-3	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Dibenzofuran		132-64-9	7	14	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
3,3-Dichlorobenzidine		91-94-1	NE	NE	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
2,4-Dichlorophenol		120-83-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Diethyl phthalate		84-66-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Dimethyl phthalate		131-11-3	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2,4-Dimethylphenol		105-67-9	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Di-n-butyl phthalate		84-74-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4,6-Dinitro-2-methylphenol		534-52-1	NE	NE	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
2,4-Dinitrophenol		51-28-5	NE	NE	9.6 UJ	2.1 UJ	1.8 UJ	1.9 UJ	1.8 UJ	1.9 UJ	1.8 UJ
2,4-Dinitrotoluene		121-14-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2,6-Dinitrotoluene		606-20-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Di-n-octyl phthalate		117-84-0	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Hexachlorobenzene		118-74-1	0.33	0.33	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Hexachlorobutadiene (C-46)		87-68-3	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Hexachlorocyclopentadiene		77-47-4	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U

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				Location Name	SSSB-19	SSSB-19	SSSB-19	SSSB-19	SSSB-20	SSSB-20	SSSB-21
				Sample Name	SSSB-19(7.5-8.5)	SSSB-DUP-01	SSSB-19(13.5-15)	SSSB-19(33-34)	SSSB-20(23.5-24)	SSSB-20(33-34)	SSSB-21(21.5-22)
				Start Depth	7.5	7.5	13.5	33	23.5	33	21.5
				End Depth	8.5	8.5	15	34	24	34	22
				Depth Unit	ft	ft	ft	ft	ft	ft	ft
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/9/2016
				Parent Sample		SSSB-19(7.5-8.5)					
Analyte	Units	CAS No.	Unrestricted SCO	Residential SCO							
Hexachloroethane		67-72-1	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Isophorone		78-59-1	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2-Methylphenol (o-Cresol)		95-48-7	0.33	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4-Methylphenol (p-Cresol)		106-44-5	0.33	34	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
2-Nitroaniline		88-74-4	NE	NE	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
3-Nitroaniline		99-09-2	NE	NE	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
4-Nitroaniline		100-01-6	NE	NE	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
Nitrobenzene		98-95-3	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2-Nitrophenol		88-75-5	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
4-Nitrophenol		100-02-7	NE	NE	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
N-Nitrosodiphenylamine (NDFA)		86-30-6	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
N-Nitrosodi-n-propylamine (NDPA)		621-64-7	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Pentachlorophenol		87-86-5	0.8	2.4	1.9 U	0.42 U	0.36 U	0.37 U	0.36 U	0.37 U	0.36 U
Phenol		108-95-2	0.33	100	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
1,2,4,5-Tetrachlorobenzene		95-94-3	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2,3,4,6-Tetrachlorophenol		58-90-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2,4,5-Trichlorophenol		95-95-4	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
2,4,6-Trichlorophenol		88-06-2	NE	NE	0.99 U	0.22 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	ND	ND	ND	**0.69**	ND	**1.2**	ND
Total Metals	mg/kg										
Aluminum		7429-90-5	NE	NE	**9200**	**6500**	**7000**	**5900**	**6700**	**5900**	**9800**
Antimony		7440-36-0	NE	NE	4.5 UJ	4.5 UJ	4.5 UJ	4.6 UJ	4 UJ	4.5 UJ	3.8 UJ
Arsenic		7440-38-2	13	16	3.3 U	3.4 U	3.3 U	3.4 U	3 U	3.4 U	2.8 U
Barium		7440-39-3	350	350	**48**	45 U	**48**	**52**	40 U	**52**	**46**
Beryllium		7440-41-7	7.2	14	**0.64**	**0.51**	**0.74**	**0.7**	**0.52**	**0.56**	**0.84**
Cadmium		7440-43-9	2.5	2.5	0.89 U	0.9 U	0.89 U	0.91 U	0.8 U	0.9 U	0.75 U
Calcium		7440-70-2	NE	NE	**12000**	**7300**	1100 U	**1400**	**2200**	**5200**	**3300**
Chromium		7440-47-3	NE	NE	**16**	**14**	**32**	**18**	**21**	**19**	**24**
Cobalt		7440-48-4	NE	NE	11 U	11 U	11 U	11 U	10 U	11 U	**9.7**
Copper		7440-50-8	50	270	**21**	**13**	**24**	**21**	**14**	**21**	**21**
Iron		7439-89-6	NE	NE	**19000**	**15000**	**25000**	**20000**	**18000**	**22000**	**25000**
Lead		7439-92-1	63	400	**23 J**	**11 J**	**7.1**	**6.9**	**4.3**	**6.1**	**5.3**
Magnesium		7439-95-4	NE	NE	**6100**	**4500**	**2400**	**2400**	**4200**	**2800**	**6200**
Manganese		7439-96-5	1600	2000	**500**	**390**	**240**	**330**	**510**	**410**	**360**
Mercury		7439-97-6	0.18	0.81	**0.037**	0.02 U	0.019 U	0.019 U	0.017 U	0.018 U	0.019 U
Nickel		7440-02-0	30	140	**17**	**12**	**15**	**13**	**13**	**13**	**16**
Potassium		7440-09-7	NE	NE	1100 U	**1100**	**1800**	**1600**	**1200**	**1600**	**3300**

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				Location Name	SSSB-19	SSSB-19	SSSB-19	SSSB-19	SSSB-20	SSSB-20	SSSB-21
				Sample Name	SSSB-19(7.5-8.5)	SSSB-DUP-01	SSSB-19(13.5-15)	SSSB-19(33-34)	SSSB-20(23.5-24)	SSSB-20(33-34)	SSSB-21(21.5-22)
				Start Depth	7.5	7.5	13.5	33	23.5	33	21.5
				End Depth	8.5	8.5	15	34	24	34	22
				Depth Unit	ft	ft	ft	ft	ft	ft	ft
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/9/2016
				Parent Sample		SSSB-19(7.5-8.5)					
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**							
Selenium		7782-49-2	3.9	36	4.5 U	4.5 U	4.5 U	4.6 U	4 U	4.5 U	3.8 U
Silver		7440-22-4	2	36	2.2 U	2.2 U	2.2 U	2.3 U	2 U	2.3 U	1.9 U
Sodium		7440-23-5	NE	NE	1100 U	1100 U	1100 U	1100 U	1000 U	1100 U	940 U
Thallium		7440-28-0	NE	NE	4.5 U	4.5 U	4.5 U	4.6 U	4 U	4.5 U	3.8 U
Vanadium		7440-62-2	NE	NE	**40**	**25**	**38**	**29**	**34**	**30**	**41**
Zinc		7440-66-6	109	2200	**39**	**30**	**36**	**33**	**27**	**32**	**30**
Cyanides	mg/kg										
Free Cyanide		FREECN	NE	NE	2.5 U	2.6 U	2.4 U	2.2 U	2.4 U	2.2 U	1.8 U
Other											
Diesel Range Organics	mg/kg	DRO	NE	NE	**75 J**	**40 J**	9.7 U	9.9 U	9.7 U	9.8 U	9.8 U
Gasoline Range Organics	mg/kg	GRO	NE	NE	0.95 U	1.2 U	0.92 U	0.9 U	1.1 U	**4.1**	0.81 U

				Location Name	SSSB-22	SSSB-23
				Sample Name	SSSB-22(20-23)	SSSB-23(32.5-33.5)
				Start Depth	20	32.5
				End Depth	23	33.5
				Depth Unit	ft	ft
				Sample Date	3/10/2016	3/11/2016
				Parent Sample		
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**		
BTEX	mg/kg					
Benzene		71-43-2	0.06	2.9	0.0008 U	**0.019**
Toluene		108-88-3	0.7	100	0.0008 UJ	**0.0041**
Ethylbenzene		100-41-4	1	30	0.0008 U	**0.087**
o-Xylene		95-47-6	0.26	100	0.0008 U	**0.012**
m/p-Xylene		179601-23-1	0.26	100	0.0008 U	**0.015**
Total BTEX (ND=0)		TBTEX_ND0	NE	NE	ND	**0.1371**
Other VOCs	mg/kg					
Acetone		67-64-1	0.05	100	0.004 U	0.005 U
Bromochloromethane		74-97-5	NE	NE	0.0008 U	0.00076 U
Bromodichloromethane		75-27-4	NE	NE	0.0008 U	0.00076 U
Bromoform		75-25-2	NE	NE	0.0008 U	0.00076 U
Bromomethane		74-83-9	NE	NE	0.0008 U	0.00076 U
Carbon disulfide		75-15-0	NE	NE	**0.00081**	0.00076 U
Carbon tetrachloride		56-23-5	0.76	1.4	0.0008 U	0.00076 U
Chlorobenzene		108-90-7	1.1	100	0.0008 U	0.00076 U
Chloroethane		75-00-3	NE	NE	0.0008 UJ	0.00076 U
Chloroform		67-66-3	0.37	10	0.0008 U	0.00076 U
Chloromethane		74-87-3	NE	NE	0.0008 U	0.00076 U
Cyclohexane		110-82-7	NE	NE	0.0008 U	0.00076 U
1,2-Dibromo-3-chloropropane		96-12-8	NE	NE	0.0008 U	0.00076 U
Dibromochloromethane		124-48-1	NE	NE	0.0008 U	0.00076 U
1,2-Dibromoethane (EDB)		106-93-4	NE	NE	0.0008 UJ	0.00076 U
1,2-Dichlorobenzene		95-50-1	1.1	100	0.0008 U	0.00076 U
1,3-Dichlorobenzene		541-73-1	2.4	17	0.0008 U	0.00076 U
1,4-Dichlorobenzene		106-46-7	1.8	9.8	0.0008 U	0.00076 U
Dichlorodifluoromethane (Freon 12)		75-71-8	NE	NE	0.0008 U	0.00076 U
1,1-Dichloroethane		75-34-3	0.27	19	0.0008 U	0.00076 U
1,2-Dichloroethane		107-06-2	0.02	2.3	0.0008 U	0.00076 U
1,1-Dichloroethene		75-35-4	0.33	100	0.0008 U	0.00076 U
cis-1,2-Dichloroethene		156-59-2	0.25	59	0.0008 U	0.00076 U
trans-1,2-Dichloroethene		156-60-5	0.19	100	0.0008 U	0.00076 U
1,2-Dichloropropane		78-87-5	NE	NE	0.0008 U	0.00076 U
cis-1,3-Dichloropropene		10061-01-5	NE	NE	0.0008 UJ	0.00076 U
trans-1,3-Dichloropropene		10061-02-6	NE	NE	0.0008 U	0.00076 U
1,4-Dioxane		123-91-1	0.1	9.8	0.016 U	0.015 U

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Validated

				Location Name	SSSB-22	SSSB-23
				Sample Name	SSSB-22(20-23)	SSSB-23(32.5-33.5)
				Start Depth	20	32.5
				End Depth	23	33.5
				Depth Unit	ft	ft
				Sample Date	3/10/2016	3/11/2016
				Parent Sample		
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**		
2-Hexanone		591-78-6	NE	NE	0.004 UJ	0.0038 U
Isopropylbenzene		98-82-8	NE	NE	0.0008 U	**0.01**
Methyl acetate		79-20-9	NE	NE	0.004 U	0.0038 U
Methyl ethyl ketone (2-Butanone)		78-93-3	0.12	100	0.004 U	0.0038 U
Methyl tert-butyl ether (MTBE)		1634-04-4	0.93	62	0.0008 U	0.00076 U
4-Methyl-2-pentanone (MIBK)		108-10-1	NE	NE	0.004 UJ	0.0038 U
Methylcyclohexane		108-87-2	NE	NE	0.0008 U	**0.0024**
Methylene chloride		75-09-2	0.05	51	0.0008 U	0.00076 U
Styrene		100-42-5	NE	NE	0.0008 U	0.00076 U
1,1,2,2-Tetrachloroethane		79-34-5	NE	NE	0.0008 U	0.00076 UJ
Tetrachloroethene (PCE)		127-18-4	1.3	5.5	0.0008 U	0.00076 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		76-13-1	NE	NE	0.0008 U	0.00076 U
1,2,3-Trichlorobenzene		87-61-6	NE	NE	0.0008 UJ	0.00076 U
1,2,4-Trichlorobenzene		120-82-1	NE	NE	0.0008 UJ	0.00076 U
1,1,1-Trichloroethane (TCA)		71-55-6	0.68	100	0.0008 U	0.00076 U
1,1,2-Trichloroethane		79-00-5	NE	NE	0.0008 U	0.00076 U
Trichloroethene (TCE)		79-01-6	0.47	10	0.0008 U	0.00076 U
Trichlorofluoromethane (Freon 11)		75-69-4	NE	NE	0.0008 U	0.00076 U
Vinyl chloride		75-01-4	0.02	0.21	0.0008 U	0.00076 UJ
Total VOCs (ND=0)		TVOC_ND0	NE	NE	**0.00081**	**0.1495**
NYSDEC PAH17	mg/kg					
Acenaphthene		83-32-9	20	100	0.21 U	0.19 U
Acenaphthylene		208-96-8	100	100	0.21 U	0.19 U
Anthracene		120-12-7	100	100	0.21 U	0.19 U
Benzo(a)anthracene		56-55-3	1	1	0.21 U	0.19 U
Benzo(b)fluoranthene		205-99-2	1	1	0.21 U	0.19 U
Benzo(k)fluoranthene		207-08-9	0.8	1	0.21 U	0.19 U
Benzo(g,h,i)perylene		191-24-2	100	100	0.21 U	0.19 U
Benzo(a)pyrene		50-32-8	1	1	0.21 U	0.19 U
Chrysene		218-01-9	1	1	0.21 U	0.19 U
Dibenz(a,h)anthracene		53-70-3	0.33	0.33	0.21 U	0.19 U
Fluoranthene		206-44-0	100	100	0.21 U	0.19 U
Fluorene		86-73-7	30	100	0.21 U	0.19 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	0.21 U	0.19 U
2-Methylnaphthalene		91-57-6	NE	NE	0.21 U	0.19 U
Naphthalene		91-20-3	12	100	0.21 U	**0.42**

Table 1. Subsurface Soil Analysis Results

Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

				Location Name	SSSB-22	SSSB-23
				Sample Name	SSSB-22(20-23)	SSSB-23(32.5-33.5)
				Start Depth	20	32.5
				End Depth	23	33.5
				Depth Unit	ft	ft
				Sample Date	3/10/2016	3/11/2016
				Parent Sample		
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**		
Phenanthrene		85-01-8	100	100	0.21 U	0.19 U
Pyrene		129-00-0	100	100	0.21 U	0.19 U
Total PAH (17) (ND=0)		TPAH17_ND0	NE	NE	ND	**0.42**
NYSDEC PAH17 Other SVOCs	mg/kg					
Acetophenone		98-86-2	NE	NE	0.21 U	0.19 U
Atrazine		1912-24-9	NE	NE	0.21 U	0.19 U
Benzaldehyde		100-52-7	NE	NE	0.21 U	0.19 U
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	0.21 U	0.19 U
Bis(2-chloroethoxy)methane		111-91-1	NE	NE	0.21 U	0.19 U
Bis(2-chloroethyl)ether		111-44-4	NE	NE	0.21 U	0.19 U
2,2-oxybis(1-Chloropropane)		108-60-1	NE	NE	0.21 U	0.19 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	0.21 U	0.19 U
4-Bromophenyl phenyl ether		101-55-3	NE	NE	0.21 U	0.19 U
Butyl benzyl phthalate		85-68-7	NE	NE	0.21 U	0.19 U
Caprolactam		105-60-2	NE	NE	0.21 U	0.19 U
Carbazole		86-74-8	NE	NE	0.21 U	0.19 U
4-Chloro-3-methylphenol		59-50-7	NE	NE	0.21 U	0.19 U
4-Chloroaniline		106-47-8	NE	NE	0.21 U	0.19 U
2-Chloronaphthalene		91-58-7	NE	NE	0.21 U	0.19 U
2-Chlorophenol		95-57-8	NE	NE	0.21 U	0.19 U
4-Chlorophenyl phenyl ether		7005-72-3	NE	NE	0.21 U	0.19 U
Dibenzofuran		132-64-9	7	14	0.21 U	0.19 U
3,3-Dichlorobenzidine		91-94-1	NE	NE	0.4 U	0.38 U
2,4-Dichlorophenol		120-83-2	NE	NE	0.21 U	0.19 U
Diethyl phthalate		84-66-2	NE	NE	0.21 U	0.19 U
Dimethyl phthalate		131-11-3	NE	NE	0.21 U	0.19 U
2,4-Dimethylphenol		105-67-9	NE	NE	0.21 U	0.19 U
Di-n-butyl phthalate		84-74-2	NE	NE	0.21 U	0.19 U
4,6-Dinitro-2-methylphenol		534-52-1	NE	NE	0.4 U	0.38 U
2,4-Dinitrophenol		51-28-5	NE	NE	2 R	1.9 UJ
2,4-Dinitrotoluene		121-14-2	NE	NE	0.21 U	0.19 U
2,6-Dinitrotoluene		606-20-2	NE	NE	0.21 U	0.19 U
Di-n-octyl phthalate		117-84-0	NE	NE	0.21 U	0.19 U
Hexachlorobenzene		118-74-1	0.33	0.33	0.21 U	0.19 U
Hexachlorobutadiene (C-46)		87-68-3	NE	NE	0.21 U	0.19 U
Hexachlorocyclopentadiene		77-47-4	NE	NE	0.21 U	0.19 U

Table 1. Subsurface Soil Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

				Location Name	SSSB-22	SSSB-23
				Sample Name	SSSB-22(20-23)	SSSB-23(32.5-33.5)
				Start Depth	20	32.5
				End Depth	23	33.5
				Depth Unit	ft	ft
				Sample Date	3/10/2016	3/11/2016
				Parent Sample		
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**		
Hexachloroethane		67-72-1	NE	NE	0.21 U	0.19 U
Isophorone		78-59-1	NE	NE	0.21 U	0.19 U
2-Methylphenol (o-Cresol)		95-48-7	0.33	100	0.21 U	0.19 U
4-Methylphenol (p-Cresol)		106-44-5	0.33	34	0.4 U	0.38 U
2-Nitroaniline		88-74-4	NE	NE	0.4 U	0.38 U
3-Nitroaniline		99-09-2	NE	NE	0.4 U	0.38 U
4-Nitroaniline		100-01-6	NE	NE	0.4 U	0.38 U
Nitrobenzene		98-95-3	NE	NE	0.21 U	0.19 U
2-Nitrophenol		88-75-5	NE	NE	0.21 U	0.19 U
4-Nitrophenol		100-02-7	NE	NE	0.4 U	0.38 U
N-Nitrosodiphenylamine (NDFA)		86-30-6	NE	NE	0.21 U	0.19 U
N-Nitrosodi-n-propylamine (NDPA)		621-64-7	NE	NE	0.21 U	0.19 U
Pentachlorophenol		87-86-5	0.8	2.4	0.4 U	0.38 U
Phenol		108-95-2	0.33	100	0.21 U	0.19 U
1,2,4,5-Tetrachlorobenzene		95-94-3	NE	NE	0.21 U	0.19 U
2,3,4,6-Tetrachlorophenol		58-90-2	NE	NE	0.21 U	0.19 U
2,4,5-Trichlorophenol		95-95-4	NE	NE	0.21 U	0.19 U
2,4,6-Trichlorophenol		88-06-2	NE	NE	0.21 U	0.19 U
Total SVOCs (ND=0)		TSVOC_ND0	NE	NE	ND	**0.42**
Total Metals	mg/kg					
Aluminum		7429-90-5	NE	NE	**6200**	**6700**
Antimony		7440-36-0	NE	NE	4.9 UJ	4.4 UJ
Arsenic		7440-38-2	13	16	3.7 U	3.3 U
Barium		7440-39-3	350	350	**54**	**58**
Beryllium		7440-41-7	7.2	14	0.49 U	**0.73**
Cadmium		7440-43-9	2.5	2.5	0.98 U	0.89 U
Calcium		7440-70-2	NE	NE	**2700**	**2600**
Chromium		7440-47-3	NE	NE	**11**	**22**
Cobalt		7440-48-4	NE	NE	12 U	11 U
Copper		7440-50-8	50	270	**19**	**26**
Iron		7439-89-6	NE	NE	**18000**	**25000**
Lead		7439-92-1	63	400	**3**	**7.2**
Magnesium		7439-95-4	NE	NE	**1600**	**3200**
Manganese		7439-96-5	1600	2000	**240**	**340**
Mercury		7439-97-6	0.18	0.81	0.019 U	0.018 U
Nickel		7440-02-0	30	140	9.8 U	**16**
Potassium		7440-09-7	NE	NE	**1900**	**2300**

Table 1. Subsurface Soil Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

Validated

				Location Name	SSSB-22	SSSB-23
				Sample Name	SSSB-22(20-23)	SSSB-23(32.5-33.5)
				Start Depth	20	32.5
				End Depth	23	33.5
				Depth Unit	ft	ft
				Sample Date	3/10/2016	3/11/2016
				Parent Sample		
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**		
Selenium		7782-49-2	3.9	36	4.9 U	4.4 U
Silver		7440-22-4	2	36	2.5 U	2.2 U
Sodium		7440-23-5	NE	NE	1200 U	1100 U
Thallium		7440-28-0	NE	NE	4.9 U	4.4 U
Vanadium		7440-62-2	NE	NE	**28**	**36**
Zinc		7440-66-6	109	2200	**25**	**39**
Cyanides	mg/kg					
Free Cyanide		FREECN	NE	NE	2.4 U	2.1 U
Other						
Diesel Range Organics	mg/kg	DRO	NE	NE	11 U	10 U
Gasoline Range Organics	mg/kg	GRO	NE	NE	2 U	**1.3**

Notes:

Analytes in blue are not detected in any sample
mg/kg = milligrams/kilogram or parts per million (ppm)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, and Total SVOCs are calculated using detects only.
Total PAH16 is calculated using the EPA16 list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, and Pyrene
Total PAH17 is calculated using the EPA16 list of analytes plus 2-Methylnaphthalene

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

CAS No. = Chemical Abstracts Service Number
ND = Not Detected
NE = Not Established
NYSDEC = New York State Department of Environmental Conservation

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Gray shading and bolding indicates that the detected result value exceeds the Unrestricted SCO
Yellow shading and bolding indicates that the detected result value exceeds the Residential SCO

Validation Qualifiers:
R = The result is rejected.
U = The result was not detected above the reporting limit.
UJ = The results was not detected at or above the reporting limit shown and the reporting limit is estimated.

Table 2. Subsurface Soil Alkylated PAHs Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

				Location Name	SSSB-19	SSSB-19	SSSB-19	SSSB-19	SSSB-20	SSSB-20	SSSB-21	SSSB-22	SSSB-23
				Sample Name	SSSB-19(7.5-8.5)	SSSB-DUP-01	SSSB-19(13.5-15)	SSSB-19(33-34)	SSSB-20(23.5-24)	SSSB-20(33-34)	SSSB-21(21.5-22)	SSSB-22(20-23)	SSSB-23(32.5-33.5)
				Start Depth	7.5	7.5	13.5	33	23.5	33	21.5	20	32.5
				End Depth	8.5	8.5	15	34	24	34	22	23	33.5
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/9/2016	3/10/2016	3/11/2016
				Parent Sample		SSSB-19(7.5-8.5)							
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**									
Alkylated PAHs	mg/kg												
Acenaphthene		83-32-9	20	100	0.13 U	0.0039 U	**0.0015**	0.0075 U	**0.0022**	0.037 U	**0.0096**	**0.0041**	0.0075 U
Acenaphthylene		208-96-8	100	100	0.13 U	**0.037**	**0.0033**	0.0075 U	0.00074 U	0.037 U	**0.0056**	**0.0023**	0.0075 U
Anthracene		120-12-7	100	100	**0.71 J**	**0.0073 J**	**0.0062**	0.0075 U	0.00074 U	0.037 U	**0.0084**	**0.0018**	0.0075 U
Benzo(a)anthracene		56-55-3	1	1	**1.6 J**	**0.036 J**	**0.0033**	0.0075 U	0.00074 U	0.037 U	**0.023**	0.00073 U	0.0075 U
Benzo(b)fluoranthene		205-99-2	1	1	**1.5 J**	**0.071 J**	**0.0034**	0.0075 U	0.00074 U	0.037 U	**0.035**	0.00073 U	0.0075 U
Benzo(k)fluoranthene		207-08-9	0.8	1	**0.59 J**	**0.022 J**	**0.0014**	0.0075 U	0.00074 U	0.037 U	**0.012**	0.00073 U	0.0075 U
Benzo(g,h,i)perylene		191-24-2	100	100	**0.58 J**	**0.07 J**	**0.0016**	0.0075 U	0.00074 U	0.037 U	**0.015**	0.00073 U	0.0075 U
Benzo(a)pyrene		50-32-8	1	1	**1.1 J**	**0.052 J**	**0.0021**	0.0075 U	0.00074 U	0.037 U	**0.026**	0.00073 U	0.0075 U
Benzo(e)pyrene		192-97-2	NE	NE	**0.77 J**	**0.04 J**	**0.0017**	0.0075 U	0.00074 U	0.037 U	**0.017**	0.00073 U	0.0075 U
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	0.13 U	0.0039 U	**0.0053**	0.0075 U	0.00074 U	0.037 U	**0.0044**	**0.0072**	0.0075 U
Chrysene		218-01-9	1	1	**1.6 J**	**0.047 J**	**0.0035**	0.0075 U	0.00074 U	0.037 U	**0.025**	0.00073 U	0.0075 U
C1-Chrysenes		CHRYC1	NE	NE	**0.81 J**	**0.041 J**	**0.0017 J**	0.0075 U	0.00074 U	0.037 U	**0.02 J**	0.00073 U	0.0075 U
C2-Chrysenes		CHRYC2	NE	NE	**0.26 J**	**0.02 J**	0.00075 U	0.0075 U	0.00074 U	0.037 U	**0.0077 J**	0.00073 U	0.0075 U
C3-Chrysenes		CHRYC3	NE	NE	0.13 U	**0.0093 J**	0.00075 U	0.0075 U	0.00074 U	0.037 U	**0.0027 J**	0.00073 U	0.0075 U
C4-Chrysenes		CHRYC4	NE	NE	0.13 U	0.0039 U	0.00075 U	0.0075 U	0.00074 U	0.037 U	0.0011 U	0.00073 U	0.0075 U
Dibenz(a,h)anthracene		53-70-3	0.33	0.33	**0.23 J**	**0.02 J**	0.00075 U	0.0075 U	0.00074 U	0.037 U	**0.006**	0.00073 U	0.0075 U
Dibenzothiophene		132-65-0	NE	NE	**0.16 J**	0.0039 UJ	**0.0015**	0.0075 U	0.00074 U	0.037 U	**0.0041**	**0.0019**	0.0075 U
C1-Dibenzothiophenes		DIBENTHPHC1	NE	NE	**0.15 J**	**0.0047 J**	**0.0016 J**	0.0075 U	0.00074 U	0.037 U	**0.0025 J**	0.00073 U	0.0075 U
C2-Dibenzothiophenes		DIBENTHPHC2	NE	NE	0.13 U	**0.0052 J**	**0.00077 J**	0.0075 U	0.00074 U	0.037 U	**0.0017 J**	0.00073 U	0.0075 U
C3-Dibenzothiophenes		DIBENTHPHC3	NE	NE	0.13 U	**0.0048 J**	0.00075 U	0.0075 U	0.00074 U	0.037 U	0.0011 U	0.00073 U	0.0075 U
C4-Dibenzothiophenes		DIBENTHPHC4	NE	NE	0.13 U	0.0039 U	**0.0016 J**	0.0075 U	0.00074 U	0.037 U	**0.0017 J**	**0.0012 J**	0.0075 U
Fluoranthene		206-44-0	100	100	**3 J**	**0.054 J**	**0.022**	0.0075 U	**0.0028**	0.037 U	**0.043**	**0.0035**	0.0075 U
C1-Fluoranthenes/pyrenes		FLUORTHPYRC1	NE	NE	**1.5 J**	**0.055 J**	**0.0055 J**	0.0075 U	0.00074 U	0.037 U	**0.024 J**	**0.0013 J**	0.0075 U
C2-Fluoranthenes/pyrenes		FLUORTHPYRC2	NE	NE	**0.89 J**	**0.044 J**	**0.0029 J**	0.0075 U	0.00074 U	0.037 U	**0.014 J**	**0.00082 J**	0.0075 U
C3-Fluoranthenes/pyrenes		FLUORTHPYRC3	NE	NE	**0.25 J**	**0.019 J**	**0.00082 J**	0.0075 U	0.00074 U	0.037 U	**0.0059 J**	0.00073 U	0.0075 U
Fluorene		86-73-7	30	100	**0.15 J**	0.0039 UJ	**0.0031**	0.0075 U	0.00074 U	0.037 U	**0.0051**	**0.004**	0.0075 U
C1-Fluorenes		FLUORC1	NE	NE	**0.13 J**	0.0039 UJ	**0.0017 J**	0.0075 U	0.00074 U	0.037 U	**0.0039 J**	**0.0014 J**	0.0075 U
C2-Fluorenes		FLUORC2	NE	NE	0.13 U	**0.0058 J**	**0.0014 J**	0.0075 U	0.00074 U	0.037 U	**0.003 J**	**0.0012 J**	0.0075 U
C3-Fluorenes		FLUORC3	NE	NE	0.13 U	**0.0057 J**	**0.0013 J**	0.0075 U	0.00074 U	0.037 U	**0.0016 J**	**0.0013 J**	0.0075 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	**0.53 J**	**0.058 J**	**0.0015**	0.0075 U	0.00074 U	0.037 U	**0.014**	0.00073 U	0.0075 U
Naphthalene		91-20-3	12	100	**0.2 J**	**0.038 J**	**0.0072**	**0.33**	**0.0046**	**1.1**	**0.019**	**0.0073**	**0.2**
C1-Naphthalenes		NAPHC1	NE	NE	**0.39 J**	**0.064 J**	**0.014 J**	**0.044 J**	**0.0032 J**	**0.089 J**	**0.013 J**	**0.029 J**	0.0075 U
C2-Naphthalenes		NAPHC2	NE	NE	**0.23 J**	**0.045 J**	**0.021 J**	0.0075 U	**0.0037 J**	0.037 U	**0.025 J**	**0.03 J**	0.0075 U
C3-Naphthalenes		NAPHC3	NE	NE	**0.28 J**	**0.039 J**	**0.0078 J**	0.0075 U	**0.0026 J**	0.037 U	**0.013 J**	**0.0079 J**	0.0075 U
C4-Naphthalenes		NAPHC4	NE	NE	**0.16 J**	**0.024 J**	**0.0036 J**	0.0075 U	0.00074 U	0.037 U	**0.0057 J**	**0.0036 J**	0.0075 U
Perylene		198-55-0	NE	NE	**0.24 J**	**0.016 J**	0.00075 U	0.0075 U	0.00074 U	0.037 U	**0.0057**	0.00073 U	0.0075 U
Phenanthrene		85-01-8	100	100	**2.4 J**	**0.02 J**	**0.012**	0.0075 U	**0.0026**	0.037 U	**0.016**	**0.016**	0.0075 U
C1-Phenanthrenes/anthracenes		PHENANTHC1	NE	NE	**1.4 J**	**0.023 J**	**0.01 J**	0.0075 U	**0.0011 J**	0.037 U	**0.016 J**	**0.0033 J**	0.0075 U
C2-Phenanthrenes/anthracenes		PHENANTHC2	NE	NE	**0.65 J**	**0.026 J**	**0.0042 J**	0.0075 U	0.00074 U	0.037 U	**0.01 J**	**0.0017 J**	0.0075 U
C3-Phenanthrenes/anthracenes		PHENANTHC3	NE	NE	**0.24 J**	**0.015 J**	**0.001 J**	0.0075 U	0.00074 U	0.037 U	**0.0051 J**	**0.0011 J**	0.0075 U
C4-Phenanthrenes/anthracenes		PHENANTHC4	NE	NE	0.13 U	**0.0076 J**	**0.001 J**	0.0075 U	0.00074 U	0.037 U	**0.0031 J**	**0.00096 J**	0.0075 U
Pyrene		129-00-0	100	100	**2.7 J**	**0.075 J**	**0.016**	0.0075 U	**0.0021**	0.037 U	**0.035**	**0.0024**	0.0075 U

Notes:

Analytes in blue are not detected in any sample
mg/kg = milligrams/kilogram or parts per million (ppm)

PAH = Polycyclic Aromatic Hydrocarbon

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York
Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

CAS No. = Chemical Abstracts Service Number
NE = Not Established

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Gray shading and bolding indicates that the detected result value exceeds the Unrestricted SCO
Yellow shading and bolding indicates that the detected result value exceeds the Residential SCO

Validation Qualifiers:
J = The result is an estimated value.
U = The result was not detected above the reporting limit.
UJ = The results was not detected at or above the reporting limit shown and the reporting limit is estimated.

Table 3. Soil Disposal #1 Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

Analyte	Units	CAS No.	Unrestricted SCO	Residential SCO	SSDIS-COMP-1	SSDIS-COMP-2	SSDIS-COMP-3	SSDIS-COMP-4	SSSB-19 GRAB 5	SSSB-20 GRAB 5	SSSB-23 GRAB 5	SSSB-23 GRAB 7
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/11/2016
				Parent Sample								
BTEX	mg/kg											
Benzene		71-43-2	0.06	2.9	NA	NA	NA	NA	0.00075 U	0.00065 U	**0.0021**	0.001 U
Toluene		108-88-3	0.7	100	NA	NA	NA	NA	0.00075 U	0.00065 U	**0.0015**	0.001 U
Ethylbenzene		100-41-4	1	30	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	**0.0045**
o-Xylene		95-47-6	0.26	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
m/p-Xylene		179601-23-1	0.26	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	**0.0011**
Other VOCs	mg/kg											
Acetone		67-64-1	0.05	100	NA	NA	NA	NA	0.0038 U	**0.07**	**0.096**	**0.012**
Bromochloromethane		74-97-5	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Bromodichloromethane		75-27-4	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Bromoform		75-25-2	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Bromomethane		74-83-9	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Carbon disulfide		75-15-0	NE	NE	NA	NA	NA	NA	0.00075 U	**0.0013**	0.00094 U	0.001 U
Carbon tetrachloride		56-23-5	0.76	1.4	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Chlorobenzene		108-90-7	1.1	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Chloroethane		75-00-3	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Chloroform		67-66-3	0.37	10	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Chloromethane		74-87-3	NE	NE	NA	NA	NA	NA	0.00075 U*	0.00065 U	0.00094 U	0.001 U
Cyclohexane		110-82-7	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2-Dibromo-3-chloropropane		96-12-8	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Dibromochloromethane		124-48-1	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2-Dibromoethane (EDB)		106-93-4	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2-Dichlorobenzene		95-50-1	1.1	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,3-Dichlorobenzene		541-73-1	2.4	17	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,4-Dichlorobenzene		106-46-7	1.8	9.8	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Dichlorodifluoromethane (Freon 12)		75-71-8	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,1-Dichloroethane		75-34-3	0.27	19	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2-Dichloroethane		107-06-2	0.02	2.3	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,1-Dichloroethene		75-35-4	0.33	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
cis-1,2-Dichloroethene		156-59-2	0.25	59	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
trans-1,2-Dichloroethene		156-60-5	0.19	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2-Dichloropropane		78-87-5	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
cis-1,3-Dichloropropene		10061-01-5	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
trans-1,3-Dichloropropene		10061-02-6	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,4-Dioxane		123-91-1	0.1	9.8	NA	NA	NA	NA	0.015 U	0.013 U	0.019 U	0.021 U
2-Hexanone		591-78-6	NE	NE	NA	NA	NA	NA	0.0038 U	0.0033 U	0.0047 U	0.0051 U
Isopropylbenzene		98-82-8	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Methyl acetate		79-20-9	NE	NE	NA	NA	NA	NA	0.0038 U	0.0033 U	0.0047 U	0.0051 U
Methyl ethyl ketone (2-Butanone)		78-93-3	0.12	100	NA	NA	NA	NA	0.0038 U	0.0033 U	0.0047 U	0.0051 U
Methyl tert-butyl ether (MTBE)		1634-04-4	0.93	62	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
4-Methyl-2-pentanone (MIBK)		108-10-1	NE	NE	NA	NA	NA	NA	0.0038 U	0.0033 U	0.0047 U	0.0051 U
Methylcyclohexane		108-87-2	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Methylene chloride		75-09-2	0.05	51	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	**0.0037**

Table 3. Soil Disposal #1 Analysis Results

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Analyte	Units	CAS No.	Unrestricted SCO	Residential SCO	SSDIS-COMP-1	SSDIS-COMP-2	SSDIS-COMP-3	SSDIS-COMP-4	SSSB-19 GRAB 5	SSSB-20 GRAB 5	SSSB-23 GRAB 5	SSSB-23 GRAB 7
				Sample Name	SSDIS-COMP-1	SSDIS-COMP-2	SSDIS-COMP-3	SSDIS-COMP-4	SSSB-19 GRAB 5	SSSB-20 GRAB 5	SSSB-23 GRAB 5	SSSB-23 GRAB 7
				Sample Date	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/11/2016	3/10/2016	3/10/2016	3/11/2016
				Parent Sample								
Styrene		100-42-5	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,1,2,2-Tetrachloroethane		79-34-5	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Tetrachloroethene (PCE)		127-18-4	1.3	5.5	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		76-13-1	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,2,4-Trichlorobenzene		120-82-1	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,1,1-Trichloroethane (TCA)		71-55-6	0.68	100	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
1,1,2-Trichloroethane		79-00-5	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Trichloroethene (TCE)		79-01-6	0.47	10	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Trichlorofluoromethane (Freon 11)		75-69-4	NE	NE	NA	NA	NA	NA	0.00075 U	0.00065 U	0.00094 U	0.001 U
Vinyl chloride		75-01-4	0.02	0.21	NA	NA	NA	NA	0.00075 U*	0.00065 U	0.00094 U	0.001 U
TCLP VOCs	mg/L											
Benzene		71-43-2	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Carbon tetrachloride		56-23-5	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Chlorobenzene		108-90-7	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Chloroform		67-66-3	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
1,2-Dichloroethane		107-06-2	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
1,1-Dichloroethene		75-35-4	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Methyl ethyl ketone (2-Butanone)		78-93-3	NA	NA	NA	NA	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U
Tetrachloroethene (PCE)		127-18-4	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Trichloroethene (TCE)		79-01-6	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
Vinyl chloride		75-01-4	NA	NA	NA	NA	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U
NYSDEC PAH17	mg/kg											
Acenaphthene		83-32-9	20	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Acenaphthylene		208-96-8	100	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Anthracene		120-12-7	100	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Benzo(a)anthracene		56-55-3	1	1	**0.13**	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Benzo(b)fluoranthene		205-99-2	1	1	**0.18**	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Benzo(k)fluoranthene		207-08-9	0.8	1	**0.069**	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Benzo(g,h,i)perylene		191-24-2	100	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Benzo(a)pyrene		50-32-8	1	1	**0.14**	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Chrysene		218-01-9	1	1	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Dibenz(a,h)anthracene		53-70-3	0.33	0.33	**0.042**	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Fluoranthene		206-44-0	100	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Fluorene		86-73-7	30	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	**0.11**	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
2-Methylnaphthalene		91-57-6	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Naphthalene		91-20-3	12	100	**0.59**	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Phenanthrene		85-01-8	100	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Pyrene		129-00-0	100	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA

Table 3. Soil Disposal #1 Analysis Results
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				Sample Name Sample Date Parent Sample	SSDIS-COMP-1 3/11/2016	SSDIS-COMP-2 3/11/2016	SSDIS-COMP-3 3/11/2016	SSDIS-COMP-4 3/11/2016	SSSB-19 GRAB 5 3/11/2016	SSSB-20 GRAB 5 3/10/2016	SSSB-23 GRAB 5 3/10/2016	SSSB-23 GRAB 7 3/11/2016
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**								
NYSDEC PAH17 Other SVOCs	mg/kg											
Acetophenone		98-86-2	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Atrazine		1912-24-9	NE	NE	0.15 U	0.16 U	0.15 U	0.15 U	NA	NA	NA	NA
Benzaldehyde		100-52-7	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Biphenyl (1,1-Biphenyl)		92-52-4	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Bis(2-chloroethoxy)methane		111-91-1	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Bis(2-chloroethyl)ether		111-44-4	NE	NE	0.038 U	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
2,2-oxybis(1-Chloropropane)		108-60-1	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Bromophenyl phenyl ether		101-55-3	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Butyl benzyl phthalate		85-68-7	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Caprolactam		105-60-2	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Chloro-3-methylphenol		59-50-7	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Chloroaniline		106-47-8	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2-Chloronaphthalene		91-58-7	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2-Chlorophenol		95-57-8	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Chlorophenyl phenyl ether		7005-72-3	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Dibenzofuran		132-64-9	7	14	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
3,3-Dichlorobenzidine		91-94-1	NE	NE	0.15 U	0.16 U	0.15 U	0.15 U	NA	NA	NA	NA
2,4-Dichlorophenol		120-83-2	NE	NE	0.15 U	0.16 U	0.15 U	0.15 U	NA	NA	NA	NA
Diethyl phthalate		84-66-2	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Dimethyl phthalate		131-11-3	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2,4-Dimethylphenol		105-67-9	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Di-n-butyl phthalate		84-74-2	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol		534-52-1	NE	NE	0.3 U	0.32 U	0.3 U	0.3 U	NA	NA	NA	NA
2,4-Dinitrophenol		51-28-5	NE	NE	0.3 U	0.32 U	0.3 U	0.3 U	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
2,6-Dinitrotoluene		606-20-2	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Di-n-octyl phthalate		117-84-0	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Hexachlorobenzene		118-74-1	0.33	0.33	0.038 U	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Hexachlorobutadiene (C-46)		87-68-3	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Hexachlorocyclopentadiene		77-47-4	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Hexachloroethane		67-72-1	NE	NE	0.038 U	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Isophorone		78-59-1	NE	NE	**0.22**	0.16 U	0.15 U	0.15 U	NA	NA	NA	NA
2-Methylphenol (o-Cresol)		95-48-7	0.33	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Methylphenol (p-Cresol)		106-44-5	0.33	34	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2-Nitroaniline		88-74-4	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
3-Nitroaniline		99-09-2	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Nitroaniline		100-01-6	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
Nitrobenzene		98-95-3	NE	NE	0.038 U	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
2-Nitrophenol		88-75-5	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
4-Nitrophenol		100-02-7	NE	NE	0.76 U	0.81 U	0.75 U	0.75 U	NA	NA	NA	NA

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				Sample Name Sample Date Parent Sample	SSDIS-COMP-1 3/11/2016	SSDIS-COMP-2 3/11/2016	SSDIS-COMP-3 3/11/2016	SSDIS-COMP-4 3/11/2016	SSSB-19 GRAB 5 3/11/2016	SSSB-20 GRAB 5 3/10/2016	SSSB-23 GRAB 5 3/10/2016	SSSB-23 GRAB 7 3/11/2016
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**								
N-Nitrosodiphenylamine (NDFA)		86-30-6	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
N-Nitrosodi-n-propylamine (NDPA)		621-64-7	NE	NE	0.038 U	0.04 U	0.037 U	0.037 U	NA	NA	NA	NA
Pentachlorophenol		87-86-5	0.8	2.4	0.3 U	0.32 U	0.3 U	0.3 U	NA	NA	NA	NA
Phenol		108-95-2	0.33	100	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
1,2,4,5-Tetrachlorobenzene		95-94-3	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2,3,4,6-Tetrachlorophenol		58-90-2	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2,4,5-Trichlorophenol		95-95-4	NE	NE	0.38 U	0.4 U	0.37 U	0.37 U	NA	NA	NA	NA
2,4,6-Trichlorophenol		88-06-2	NE	NE	0.15 U	0.16 U	0.15 U	0.15 U	NA	NA	NA	NA
TCLP SVOCs	mg/L											
1,4-Dichlorobenzene		106-46-7	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	NA	NA	NA	NA
Hexachlorobenzene		118-74-1	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA
Hexachlorobutadiene (C-46)		87-68-3	NA	NA	0.002 U	0.002 U	0.002 U	0.002 U	NA	NA	NA	NA
Hexachloroethane		67-72-1	NA	NA	0.001 U	0.001 U	0.001 U	0.001 U	NA	NA	NA	NA
2-Methylphenol (o-Cresol)		95-48-7	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
3,4-Methylphenol (m,p-Cresol)		108394/106445	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
4-Methylphenol (p-Cresol)		106-44-5	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
Nitrobenzene		98-95-3	NA	NA	0.001 U*	0.001 U*	0.001 U*	0.001 U*	NA	NA	NA	NA
Pentachlorophenol		87-86-5	NA	NA	0.03 U	0.03 U	0.03 U	0.03 U	NA	NA	NA	NA
Phenol		108-95-2	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
Pyridine		110-86-1	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
2,4,5-Trichlorophenol		95-95-4	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
2,4,6-Trichlorophenol		88-06-2	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
PCB Aroclors	mg/kg											
Aroclor 1016		12674-11-2	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1221		11104-28-2	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1232		11141-16-5	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1242		53469-21-9	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1248		12672-29-6	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1254		11097-69-1	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1260		11096-82-5	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1262		37324-23-5	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Aroclor 1268		11100-14-4	NE	NE	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Total PCBs (Lab calculated)		1336-36-3	0.1	1	0.076 U	0.081 U	0.075 U	0.075 U	NA	NA	NA	NA
Total Metals	mg/kg											
Antimony		7440-36-0	NE	NE	11 U	12 U	11 U	11 U	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	**4**	2.4 U	2.1 U	2.2 U	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	14	1.1 U	1.2 U	1.1 U	1.1 U	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	2.5	1.1 U	1.2 U	1.1 U	1.1 U	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	**20**	**23**	**22**	**24**	NA	NA	NA	NA
Copper		7440-50-8	50	270	**24**	**25**	**21**	**26**	NA	NA	NA	NA
Lead		7439-92-1	63	400	**99**	**14**	**14**	**26**	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	**0.16**	0.019 U	**0.018**	0.018 U	NA	NA	NA	NA

Table 3. Soil Disposal #1 Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

Analyte	Units	CAS No.	Unrestricted SCO	Residential SCO	SSDIS-COMP-1 3/11/2016	SSDIS-COMP-2 3/11/2016	SSDIS-COMP-3 3/11/2016	SSDIS-COMP-4 3/11/2016	SSSB-19 GRAB 5 3/11/2016	SSSB-20 GRAB 5 3/10/2016	SSSB-23 GRAB 5 3/10/2016	SSSB-23 GRAB 7 3/11/2016
Nickel		7440-02-0	30	140	**19**	**18**	**14**	**19**	NA	NA	NA	NA
Selenium		7782-49-2	3.9	36	2.2 U	2.4 U	2.1 U	2.2 U	NA	NA	NA	NA
Silver		7440-22-4	2	36	1.1 U	1.2 U	1.1 U	1.1 U	NA	NA	NA	NA
Sulfur		7704-34-9	NE	NE	**280**	**80**	54 U	55 U	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	2.2 U	2.4 U	2.1 U	2.2 U	NA	NA	NA	NA
Zinc		7440-66-6	109	2200	**80**	**41**	**30**	**40**	NA	NA	NA	NA
TCLP Metals	mg/L											
Antimony		7440-36-0	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA	NA
Arsenic		7440-38-2	NA	NA	0.075 U	0.075 U	0.075 U	0.075 U	NA	NA	NA	NA
Beryllium		7440-41-7	NA	NA	0.01 U	0.01 U	0.01 U	0.01 U	NA	NA	NA	NA
Cadmium		7440-43-9	NA	NA	0.02 U	0.02 U	0.02 U	0.02 U	NA	NA	NA	NA
Chromium		7440-47-3	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA	NA
Copper		7440-50-8	NA	NA	0.13 U	0.13 U	0.13 U	0.13 U	NA	NA	NA	NA
Lead		7439-92-1	NA	NA	0.05 U	**0.12**	**0.074**	0.05 U	NA	NA	NA	NA
Mercury		7439-97-6	NA	NA	0.0002 U	0.0002 U	0.0002 U	0.0002 U	NA	NA	NA	NA
Nickel		7440-02-0	NA	NA	0.2 U	0.2 U	0.2 U	0.2 U	NA	NA	NA	NA
Selenium		7782-49-2	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA	NA
Silver		7440-22-4	NA	NA	0.05 U	0.05 U	0.05 U	0.05 U	NA	NA	NA	NA
Thallium		7440-28-0	NA	NA	0.1 U	0.1 U	0.1 U	0.1 U	NA	NA	NA	NA
Zinc		7440-66-6	NA	NA	**0.29**	0.15 U	0.15 U	0.15 U	NA	NA	NA	NA

Table 3. Soil Disposal #1 Analysis Results
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

Notes:

Data in this table have not been validated. Qualifiers are Lab Qualifiers.
Analytes in blue are not detected in any sample
mg/kg = milligrams/kilogram or parts per million (ppm)
mg/L = milligrams/liter

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
PCB = Polychlorinated Biphenyl
SVOC = Semi-Volatile Organic Compound
TCLP = Toxicity Characteristic Leaching Procedure
VOC = Volatile Organic Compound

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

CAS No. = Chemical Abstracts Service Number
NA = Not Applicable
NE = Not Established
NYSDEC = New York State Department of Environmental Conservation

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Gray shading and bolding indicates that the detected result value exceeds the Unrestricted SCO
Yellow shading and bolding indicates that the detected result value exceeds the Residential SCO

Laboratory Qualifiers:
* = The duplicate result was not within control limits.
U = The result was not detected above the reporting limit.

Table 4. Soil Disposal #2 Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

				Sample Name Sample Date	SSDIS-COMP-1 3/11/2016	SSDIS-COMP-2 3/11/2016	SSDIS-COMP-3 3/11/2016	SSDIS-COMP-4 3/11/2016	SSSB-19 GRAB 1 3/11/2016	SSSB-19 GRAB 2 3/11/2016	SSSB-19 GRAB 3 3/11/2016	SSSB-19 GRAB 4 3/11/2016	SSSB-20 GRAB 1 3/10/2016
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**									
Total Metals	mg/kg												
Barium		7440-39-3	350	350	**68**	**54**	**39**	**74**	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	**16**	**22**	**17**	**28**	NA	NA	NA	NA	NA
Trivalent Chromium (Cr III)		16065-83-1	30	36	**16**	**22**	**17**	**28**	NA	NA	NA	NA	NA
Hexavalent Chromium (Cr VI)		18540-29-9	1	22	2.3 U	2.4 U	2.2 U	2.2 U	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	**17000**	**22000**	**22000**	**25000**	NA	NA	NA	NA	NA
Molybdenum		7439-98-7	NE	NE	4.5 U	4.3 U	3.9 U	4.2 U	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	**26**	**34**	**35**	**36**	NA	NA	NA	NA	NA
Cyanides	mg/kg												
Cyanide Reactivity		REAC-CN	NE	NE	25 U	25 U	25 U	25 U	NA	NA	NA	NA	NA
TCLP Pesticides	mg/L												
gamma-BHC (gamma-Hexachlorocyclohexane) (Lindane)		58-89-9	NE	NE	0.0005 U	0.0005 U	0.0005 U	0.0005 U	NA	NA	NA	NA	NA
Chlordane (Alpha & Gamma)		57-74-9	NE	NE	0.005 U	0.005 U	0.005 U	0.005 U	NA	NA	NA	NA	NA
Endrin		72-20-8	NE	NE	0.0005 U	0.0005 U	0.0005 U	0.0005 U	NA	NA	NA	NA	NA
Heptachlor		76-44-8	NE	NE	0.0005 U	0.0005 U	0.0005 U	0.0005 U	NA	NA	NA	NA	NA
Heptachlor epoxide		1024-57-3	NE	NE	0.0005 U	0.0005 U	0.0005 U	0.0005 U	NA	NA	NA	NA	NA
Methoxychlor		72-43-5	NE	NE	0.0005 U	0.0005 U	0.0005 U	0.0005 U	NA	NA	NA	NA	NA
Toxaphene		8001-35-2	NE	NE	0.005 U	0.005 U	0.005 U	0.005 U	NA	NA	NA	NA	NA
TCLP Herbicides	mg/L												
2,4-D (2,4-Dichlorophenoxyacetic acid)		94-75-7	NE	NE	0.017 U	0.017 U	0.017 U	0.017 U	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)		93-72-1	NE	NE	0.017 U	0.017 U	0.017 U	0.017 U	NA	NA	NA	NA	NA
Other													
Corrosivity	s.u.	CORROS	NE	NE	**8.14 HF**	**7.93 HF**	**8.46 HF**	**8.55 HF**	NA	NA	NA	NA	NA
Extractable Organic Halides	mg/kg	EOX	NE	NE	NA	NA	NA	NA	57 U	57 U	55 U	57 U	52 U
Ignitibility	mm/sec	IGNIT	NE	NE	2.2 U	2.2 U	2.2 U	2.2 U	NA	NA	NA	NA	NA
pH	s.u.	pH	NE	NE	**8.14 HF**	**7.93 HF**	**8.46 HF**	**8.55 HF**	NA	NA	NA	NA	NA
Sulfide Reactivity	mg/kg	REAC-HS	NE	NE	20 U	20 U	20 U	20 U	NA	NA	NA	NA	NA
Diesel Range Organics	mg/kg	DRO	NE	NE	NA	NA	NA	NA	10 U	9.7 UF2	9.6 U	9.9 U	9.9 U
Gasoline Range Organics	mg/kg	GRO	NE	NE	NA	NA	NA	NA	1 U	0.9 U	0.85 U	0.91 U	1.7 U

Table 4. Soil Disposal #2 Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

Analyte	Units	CAS No.	Unrestricted SCO	Residential SCO	Sample Name / Sample Date	SSSB-20 GRAB 2 3/10/2016	SSSB-20 GRAB 3 3/10/2016	SSSB-20 GRAB 4 3/10/2016	SSSB-21 GRAB 1 3/9/2016	SSSB-21 GRAB 2 3/9/2016	SSSB-21 GRAB 3 3/9/2016	SSSB-21 GRAB 4 3/9/2016	SSSB-22 GRAB 1 3/10/2016
Total Metals	mg/kg												
Barium		7440-39-3	350	350		NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Trivalent Chromium (Cr III)		16065-83-1	30	36		NA	NA	NA	NA	NA	NA	NA	NA
Hexavalent Chromium (Cr VI)		18540-29-9	1	22		NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Molybdenum		7439-98-7	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Cyanides	mg/kg												
Cyanide Reactivity		REAC-CN	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
TCLP Pesticides	mg/L												
gamma-BHC (gamma-Hexachlorocyclohexane) (Lindane)		58-89-9	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Chlordane (Alpha & Gamma)		57-74-9	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Endrin		72-20-8	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor		76-44-8	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide		1024-57-3	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Methoxychlor		72-43-5	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene		8001-35-2	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
TCLP Herbicides	mg/L												
2,4-D (2,4-Dichlorophenoxyacetic acid)		94-75-7	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)		93-72-1	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Other													
Corrosivity	s.u.	CORROS	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Extractable Organic Halides	mg/kg	EOX	NE	NE		52 U	58 U	53 U	61 U	52 U	57 U	51 U	58 U
Ignitibility	mm/sec	IGNIT	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
pH	s.u.	pH	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Sulfide Reactivity	mg/kg	REAC-HS	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA
Diesel Range Organics	mg/kg	DRO	NE	NE		9.7 U	11 U	9.7 U	11 U	9.9 U	9.6 U	9.8 U	11 U
Gasoline Range Organics	mg/kg	GRO	NE	NE		1.6 U	1.6 U	**5.7**	0.92 U	0.76 U	0.78 U	**3.4**	**2.1**

Table 4. Soil Disposal #2 Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

				Sample Name Sample Date	SSSB-22 GRAB 2 3/10/2016	SSSB-22 GRAB 3 3/10/2016	SSSB-22 GRAB 4 3/10/2016	SSSB-23 GRAB 1 3/10/2016	SSSB-23 GRAB 2 3/10/2016	SSSB-23 GRAB 3 3/11/2016	SSSB-23 GRAB 4 3/11/2016
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Residential SCO**							
Total Metals	mg/kg										
Barium		7440-39-3	350	350	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NA	NA	NA	NA	NA	NA	NA
Trivalent Chromium (Cr III)		16065-83-1	30	36	NA	NA	NA	NA	NA	NA	NA
Hexavalent Chromium (Cr VI)		18540-29-9	1	22	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NA	NA	NA	NA	NA	NA	NA
Molybdenum		7439-98-7	NE	NE	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NA	NA	NA	NA	NA	NA	NA
Cyanides	mg/kg										
Cyanide Reactivity		REAC-CN	NE	NE	NA	NA	NA	NA	NA	NA	NA
TCLP Pesticides	mg/L										
gamma-BHC (gamma-Hexachlorocyclohexane) (Lindane)		58-89-9	NE	NE	NA	NA	NA	NA	NA	NA	NA
Chlordane (Alpha & Gamma)		57-74-9	NE	NE	NA	NA	NA	NA	NA	NA	NA
Endrin		72-20-8	NE	NE	NA	NA	NA	NA	NA	NA	NA
Heptachlor		76-44-8	NE	NE	NA	NA	NA	NA	NA	NA	NA
Heptachlor epoxide		1024-57-3	NE	NE	NA	NA	NA	NA	NA	NA	NA
Methoxychlor		72-43-5	NE	NE	NA	NA	NA	NA	NA	NA	NA
Toxaphene		8001-35-2	NE	NE	NA	NA	NA	NA	NA	NA	NA
TCLP Herbicides	mg/L										
2,4-D (2,4-Dichlorophenoxyacetic acid)		94-75-7	NE	NE	NA	NA	NA	NA	NA	NA	NA
2,4,5-TP (Silvex)		93-72-1	NE	NE	NA	NA	NA	NA	NA	NA	NA
Other											
Corrosivity	s.u.	CORROS	NE	NE	NA	NA	NA	NA	NA	NA	NA
Extractable Organic Halides	mg/kg	EOX	NE	NE	56 U	58 U	56 U	61 U	69 U	54 U	56 U
Ignitibility	mm/sec	IGNIT	NE	NE	NA	NA	NA	NA	NA	NA	NA
pH	s.u.	pH	NE	NE	NA	NA	NA	NA	NA	NA	NA
Sulfide Reactivity	mg/kg	REAC-HS	NE	NE	NA	NA	NA	NA	NA	NA	NA
Diesel Range Organics	mg/kg	DRO	NE	NE	9.7 U	9.9 U	9.8 U	10 U	12 U	**51**	9.7 U
Gasoline Range Organics	mg/kg	GRO	NE	NE	1.6 U	1.4 U	1.4 U	1.7 U	2.6 U	1.2 U	**0.84**

Table 4. Soil Disposal #2 Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

Notes:

Data in this table have not been validated. Qualifiers are Lab Qualifiers.

Analytes in blue are not detected in any sample.
mg/kg = milligrams/kilogram or parts per million (ppm)
mg/L = milligrams/liter
mm/sec = millimeters per second
s.u. = standard units

TCLP = Toxicity Characteristic Leaching Procedure

6 NYCRR = New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

Comparison of detected results are performed against one or more of the following NYCRR, Chapter IV, Part 375-6 Soil Cleanup Objectives (SCO)s: Unrestricted Use, Residential, Restricted-Residential, Commercial, Industrial, Protection of Ecological Resources, or Protection of Groundwater

CAS No. = Chemical Abstracts Service Number
NE = Not Established

Bolding indicates a detected result concentration
Gray shading and bolding indicates that the detected result value exceeds the Unrestricted SCO
Yellow shading and bolding indicates that the detected result value exceeds the Residential SCO

Laboratory Qualifiers:
F2 = MS and/or MSD recovery exceeds the control limits.
H = The sample was prepared or analyzed beyond the holding time.
U = The result was not detected above the reporting limit.

Table 5. Soil Disposal #3 Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

		Sample Name Sample Date	SSDIS-COMP-1 3/11/2016	SSDIS-COMP-2 3/11/2016	SSDIS-COMP-3 3/11/2016	SSDIS-COMP-4 3/11/2016
Analyte	**Units**	**CAS No.**				
Other						
C9-C40	mg/kg	TEPH9-40	**47**	2.5 U	2.3 U	2.2 U

Notes:

Data in this table have not been validated. Qualifiers are Lab Qualifiers.

mg/kg = milligrams/kilogram or parts per million (ppm)

CAS No. = Chemical Abstracts Service Number

Bolding indicates a detected result concentration

Laboratory Qualifiers:

U = The result was not detected above the reporting limit.

Table 6. Final Groundwater Low-flow Sampling Parameters
Pre-Design Investigation Data Summary Report
Former Skillman Street Holder Station Site
National Grid
Brooklyn, New York

Well ID	Date Sampled	Temperature (deg. C)	Conductivity (mS/cm)	Dissolved Oxygen (mg/L)	pH (S.U.)	Oxidation-Reduction Potential (mV)	Turbidity (NTU)
SSGW-19	3/11/2016						
SSGW-23	3/11/2016	14.57	921	1.17	6.91	-191.9	315.4

Notes:
deg. C - degrees Celsius
mS/cm - milliSiemens per centimeter
mg/L - milligrams per liter
S.U. - Standard units
mV - milliVolts
NTU - Nephelometric Turbidity Units

Table 7. Groundwater Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

			Location Name	SSGW-19	SSGW-23	SSGW-23
			Sample Name	SSGW-19(14-24)	SSGW-23(15-25)	SSSB-DUP-02
			Well Screen Start Depth	14	15	15
			Well Screen End Depth	24	25	25
			Depth Unit	ft	ft	ft
			Sample Date	3/11/2016	3/11/2016	3/11/2016
			Parent Sample			SSGW-23(15-25)
Analyte	Units	CAS No.	NYS AWQS			
BTEX	ug/L					
Benzene		71-43-2	1	1 U	**1.7**	**1.7**
Toluene		108-88-3	5	1 U	1 U	1 U
Ethylbenzene		100-41-4	5	1 U	**1.8**	**1.6**
o-Xylene		95-47-6	5	1 U	1 U	**1**
m/p-Xylene		179601-23-1	5	1 U	1 U	1.4 U
Total BTEX (ND=0)		TBTEX_ND0	NE	ND	**3.5**	**4.3**
Other VOCs	ug/L					
Acetone		67-64-1	50*	5 U	5 U	5 U
Bromochloromethane		74-97-5	5	1 U	1 U	1 U
Bromodichloromethane		75-27-4	50*	**4**	**2.6**	**2.6**
Bromoform		75-25-2	50*	1 U	1 U	1 U
Bromomethane		74-83-9	5	1 U	1 U	1 U
Carbon disulfide		75-15-0	60*	1 U	1 U	1 U
Carbon tetrachloride		56-23-5	5	1 U	1 U	1 U
Chlorobenzene		108-90-7	5	1 U	1 U	1 U
Chloroethane		75-00-3	5	1 U	1 U	1 U
Chloroform		67-66-3	7	**15**	**11**	**11**
Chloromethane		74-87-3	5	1 U	1 U	1 U
Cyclohexane		110-82-7	NE	1 U	1 U	1 U
1,2-Dibromo-3-chloropropane		96-12-8	0.04	1 U	1 U	1 U
Dibromochloromethane		124-48-1	50*	1 U	1 U	1 U
1,2-Dibromoethane (EDB)		106-93-4	0.0006	1 U	1 U	1 U
1,2-Dichlorobenzene		95-50-1	3	1 U	1 U	1 U
1,3-Dichlorobenzene		541-73-1	3	1 U	1 U	1 U
1,4-Dichlorobenzene		106-46-7	3	1 U	1 U	1 U
Dichlorodifluoromethane (Freon 12)		75-71-8	5	1 U	1 U	1 U
1,1-Dichloroethane		75-34-3	5	1 U	1 U	1 U
1,2-Dichloroethane		107-06-2	0.6	1 U	1 U	1 U
1,1-Dichloroethene		75-35-4	5	1 U	1 U	1 U
cis-1,2-Dichloroethene		156-59-2	5	1 U	1 U	1 U
trans-1,2-Dichloroethene		156-60-5	5	1 U	1 U	1 U
1,2-Dichloropropane		78-87-5	1	1 U	1 U	1 U
cis-1,3-Dichloropropene		10061-01-5	0.4	1 U	1 U	1 U
trans-1,3-Dichloropropene		10061-02-6	0.4	1 U	1 U	1 U
1,4-Dioxane		123-91-1	NE	50 U	50 U	50 U
2-Hexanone		591-78-6	50*	5 U	5 U	5 U
Isopropylbenzene		98-82-8	5	1 U	1 U	1 U
Methyl acetate		79-20-9	NE	5 UJ	5 UJ	5 UJ
Methyl ethyl ketone (2-Butanone)		78-93-3	50*	5 U	5 U	5 U
Methyl tert-butyl ether (MTBE)		1634-04-4	10*	1 U	1 U	1 U
4-Methyl-2-pentanone (MIBK)		108-10-1	NE	5 U	5 U	5 U
Methylcyclohexane		108-87-2	NE	1 U	1 U	1 U
Methylene chloride		75-09-2	5	1 U	1 U	1 U
Styrene		100-42-5	5	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane		79-34-5	5	1 UJ	1 UJ	1 UJ

Table 7. Groundwater Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

			Location Name	SSGW-19	SSGW-23	SSGW-23
			Sample Name	SSGW-19(14-24)	SSGW-23(15-25)	SSSB-DUP-02
			Well Screen Start Depth	14	15	15
			Well Screen End Depth	24	25	25
			Depth Unit	ft	ft	ft
			Sample Date	3/11/2016	3/11/2016	3/11/2016
			Parent Sample			SSGW-23(15-25)
Analyte	Units	CAS No.	NYS AWQS			
Tetrachloroethene (PCE)		127-18-4	5	**1.8**	**1**	**1.1**
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)		76-13-1	5	1 U	1 U	1 U
1,2,3-Trichlorobenzene		87-61-6	5	1 UJ	1 UJ	1 UJ
1,2,4-Trichlorobenzene		120-82-1	5	1 U	1 U	1 U
1,1,1-Trichloroethane (TCA)		71-55-6	5	1 U	1 U	1 U
1,1,2-Trichloroethane		79-00-5	1	1 UJ	1 UJ	1 UJ
Trichloroethene (TCE)		79-01-6	5	1 U	1 U	1 U
Trichlorofluoromethane (Freon 11)		75-69-4	5	1 UJ	1 UJ	1 UJ
Vinyl chloride		75-01-4	2	1 U	1 U	1 U
Total VOCs (ND=0)		TVOC_ND0	NE	**20.8**	**18.1**	**19**
NYSDEC PAH17	ug/L					
Acenaphthene		83-32-9	20*	11 U	11 U	11 U
Acenaphthylene		208-96-8	NE	11 U	11 U	11 U
Anthracene		120-12-7	50*	11 U	11 U	11 U
Benzo(a)anthracene		56-55-3	0.002*	1.1 U	1.1 U	1.1 U
Benzo(b)fluoranthene		205-99-2	0.002*	1.1 U	1.1 U	1.1 U
Benzo(k)fluoranthene		207-08-9	0.002*	1.1 U	1.1 U	1.1 U
Benzo(g,h,i)perylene		191-24-2	NE	11 UJ	11 U	11 U
Benzo(a)pyrene		50-32-8	ND	1.1 U	1.1 U	1.1 U
Chrysene		218-01-9	0.002*	2.2 U	2.3 U	2.3 U
Dibenz(a,h)anthracene		53-70-3	NE	1.1 UJ	1.1 U	1.1 U
Fluoranthene		206-44-0	50*	11 U	11 U	11 U
Fluorene		86-73-7	50*	11 U	11 U	11 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.002*	1.1 UJ	1.1 U	1.1 U
2-Methylnaphthalene		91-57-6	NE	11 U	11 U	11 U
Naphthalene		91-20-3	10*	11 U	11 U	11 U
Phenanthrene		85-01-8	50*	11 U	11 U	11 U
Pyrene		129-00-0	50*	11 U	11 U	11 U
Total PAH (17) (ND=0)		TPAH17_ND0	NE	ND	ND	ND
NYSDEC PAH17 Other SVOCs	ug/L					
Acetophenone		98-86-2	NE	11 U	11 U	11 U
Atrazine		1912-24-9	7.5	2.2 U	2.3 U	2.3 U
Benzaldehyde		100-52-7	NE	11 U	11 U	11 U
Biphenyl (1,1-Biphenyl)		92-52-4	5	11 U	11 U	11 U
Bis(2-chloroethoxy)methane		111-91-1	5	11 U	11 U	11 U
Bis(2-chloroethyl)ether		111-44-4	1	1.1 U	1.1 U	1.1 U
2,2-oxybis(1-Chloropropane)		108-60-1	5	11 U	11 U	11 U
Bis(2-ethylhexyl)phthalate		117-81-7	5	2.2 U	**5.1**	**5.8**
4-Bromophenyl phenyl ether		101-55-3	NE	11 U	11 U	11 U
Butyl benzyl phthalate		85-68-7	50*	11 U	11 U	11 U
Caprolactam		105-60-2	NE	11 U	11 U	11 U
Carbazole		86-74-8	NE	11 U	11 U	11 U
4-Chloro-3-methylphenol		59-50-7	NE	11 U	11 U	11 U
4-Chloroaniline		106-47-8	5	11 U	11 U	11 U
2-Chloronaphthalene		91-58-7	10*	11 U	11 U	11 U
2-Chlorophenol		95-57-8	NE	11 U	11 U	11 U
4-Chlorophenyl phenyl ether		7005-72-3	NE	11 U	11 U	11 U

Table 7. Groundwater Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

			Location Name	SSGW-19	SSGW-23	SSGW-23
			Sample Name	SSGW-19(14-24)	SSGW-23(15-25)	SSSB-DUP-02
			Well Screen Start Depth	14	15	15
			Well Screen End Depth	24	25	25
			Depth Unit	ft	ft	ft
			Sample Date	3/11/2016	3/11/2016	3/11/2016
			Parent Sample			SSGW-23(15-25)
Analyte	**Units**	**CAS No.**	**NYS AWQS**			
Dibenzofuran		132-64-9	NE	11 U	11 U	11 U
3,3-Dichlorobenzidine		91-94-1	5	11 U	11 U	11 U
2,4-Dichlorophenol		120-83-2	5	11 U	11 U	11 U
Diethyl phthalate		84-66-2	50*	11 U	11 U	11 U
Dimethyl phthalate		131-11-3	50*	11 U	11 U	11 U
2,4-Dimethylphenol		105-67-9	50*	11 U	11 U	11 U
Di-n-butyl phthalate		84-74-2	50	11 U	11 U	11 U
4,6-Dinitro-2-methylphenol		534-52-1	NE	22 U	23 U	23 U
2,4-Dinitrophenol		51-28-5	10*	22 U	23 U	23 U
2,4-Dinitrotoluene		121-14-2	5	2.2 U	2.3 U	2.3 U
2,6-Dinitrotoluene		606-20-2	5	2.2 U	2.3 U	2.3 U
Di-n-octyl phthalate		117-84-0	50*	11 U	11 U	11 U
Hexachlorobenzene		118-74-1	0.04	1.1 U	1.1 U	1.1 U
Hexachlorobutadiene (C-46)		87-68-3	0.5	1.1 U	1.1 U	1.1 U
Hexachlorocyclopentadiene		77-47-4	5	11 U	11 U	11 U
Hexachloroethane		67-72-1	5	1.1 U	1.1 U	1.1 U
Isophorone		78-59-1	50*	11 U	11 U	11 U
2-Methylphenol (o-Cresol)		95-48-7	1	11 U	11 U	11 U
4-Methylphenol (p-Cresol)		106-44-5	1	11 U	11 U	11 U
2-Nitroaniline		88-74-4	5	11 U	11 U	11 U
3-Nitroaniline		99-09-2	5	11 U	11 U	11 U
4-Nitroaniline		100-01-6	5	11 U	11 U	11 U
Nitrobenzene		98-95-3	0.4	1.1 U	1.1 U	1.1 U
2-Nitrophenol		88-75-5	NE	11 U	11 U	11 U
4-Nitrophenol		100-02-7	NE	22 U	23 U	23 U
N-Nitrosodiphenylamine (NDFA)		86-30-6	50*	11 U	11 U	11 U
N-Nitrosodi-n-propylamine (NDPA)		621-64-7	NE	1.1 U	1.1 U	1.1 U
Pentachlorophenol		87-86-5	1	22 U	23 U	23 U
Phenol		108-95-2	1	11 U	11 U	11 U
1,2,4,5-Tetrachlorobenzene		95-94-3	5	11 U	11 U	11 U
2,3,4,6-Tetrachlorophenol		58-90-2	NE	11 U	11 U	11 U
2,4,5-Trichlorophenol		95-95-4	NE	11 U	11 U	11 U
2,4,6-Trichlorophenol		88-06-2	NE	11 U	11 U	11 U
Total SVOCs (ND=0)		TSVOC_ND0	NE	ND	**5.1**	**5.8**
Total Metals	ug/L					
Aluminum		7429-90-5	NE	**180000**	**6500 J**	**3900 J**
Antimony		7440-36-0	3	60 UJ	20 UJ	20 UJ
Arsenic		7440-38-2	25	**47**	15 U	15 U
Barium		7440-39-3	1000	**1800**	200 U	200 U
Beryllium		7440-41-7	3*	**17**	2 U	2 U
Cadmium		7440-43-9	5	12 U	4 U	4 U
Calcium		7440-70-2	NE	**75000**	**84000**	**75000**
Chromium		7440-47-3	50	**430**	**15**	**10**
Cobalt		7440-48-4	NE	**180**	50 U	50 U
Copper		7440-50-8	200	**870**	25 U	25 U
Iron		7439-89-6	300	**420000**	**18000 J**	**13000 J**
Lead		7439-92-1	25	**180**	10 U	10 U
Magnesium		7439-95-4	35000*	**71000**	**20000**	**18000**

Table 7. Groundwater Analysis Results

Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

			Location Name	SSGW-19	SSGW-23	SSGW-23
			Sample Name	SSGW-19(14-24)	SSGW-23(15-25)	SSSB-DUP-02
			Well Screen Start Depth	14	15	15
			Well Screen End Depth	24	25	25
			Depth Unit	ft	ft	ft
			Sample Date	3/11/2016	3/11/2016	3/11/2016
			Parent Sample			SSGW-23(15-25)
Analyte	**Units**	**CAS No.**	**NYS AWQS**			
Manganese		7439-96-5	300	**7300**	**2000**	**1700**
Mercury		7439-97-6	0.7	0.2 U	0.2 U	0.2 U
Nickel		7440-02-0	100	**360**	**49**	**41**
Potassium		7440-09-7	NE	**49000**	**14000**	**13000**
Selenium		7782-49-2	10	60 U	20 U	20 U
Silver		7440-22-4	50	30 UJ	10 UJ	10 UJ
Sodium		7440-23-5	20000	**56000**	**82000**	**73000**
Thallium		7440-28-0	0.5*	60 U	20 U	20 U
Vanadium		7440-62-2	NE	**650**	50 U	50 U
Zinc		7440-66-6	2000*	**810**	**41**	30 U
Cyanides	ug/L					
Total Cyanide		57-12-5	200	**240**	**29**	**29**

Table 7. Groundwater Analysis Results
Pre-Design Investigation Data Summary Report
Skillman Street Former Holder Station Site
National Grid
Brooklyn, New York

Notes:

Analytes in blue are not detected in any sample

ug/L = micrograms per liter or parts per billion (ppb)

BTEX = Benzene, Toluene, Ethylbenzene, and Xylenes
PAH = Polycyclic Aromatic Hydrocarbon
SVOC = Semi-Volatile Organic Compound
VOC = Volatile Organic Compound

Total BTEX, Total VOCs, Total PAHs, and Total SVOCs are calculated using detects only.
Total PAH16 is calculated using the EPA16 list of analytes: Acenaphthene, Acenaphthylene, Anthracene, Benz[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, and Pyrene

Total PAH17 is calculated using the EPA16 list of analytes plus 2-Methylnaphthalene

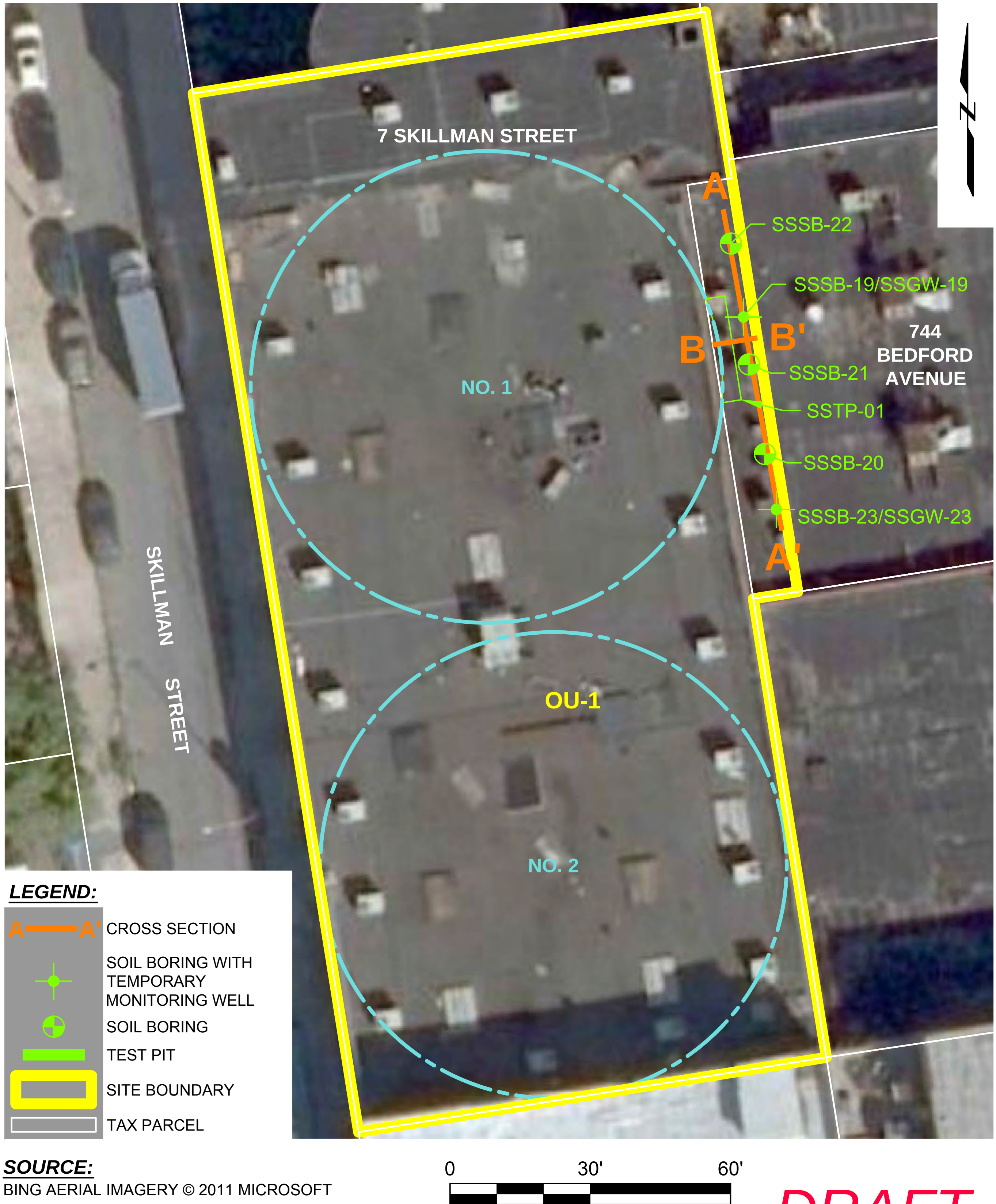
NYS AWQS = New York State Ambient Water Quality Standards and Guidance Values for GA groundwater
* indicates the value is a guidance value and not a standard

CAS No. = Chemical Abstracts Service Number
ND = Not Detected
NE = Not Established
NYSDEC = New York State Department of Environmental Conservation

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the NYSDOH guidance it was compared to
Gray shading and bolding indicates that the detected result value exceeds the NYS AWQS

Validation Qualifiers:

J = The result is an estimated value.
U = The result was not detected above the reporting limit.
UJ = The results was not detected at or above the reporting limit shown and the reporting limit is estimated.



SOURCE:
BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps)
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744 Bedford Avenue
Former Skillman Street Holder Station Site
Brooklyn, New York

nationalgrid

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SAMPLE LOCATION MAP

Project 093080 | April 2016 | Fig. 1

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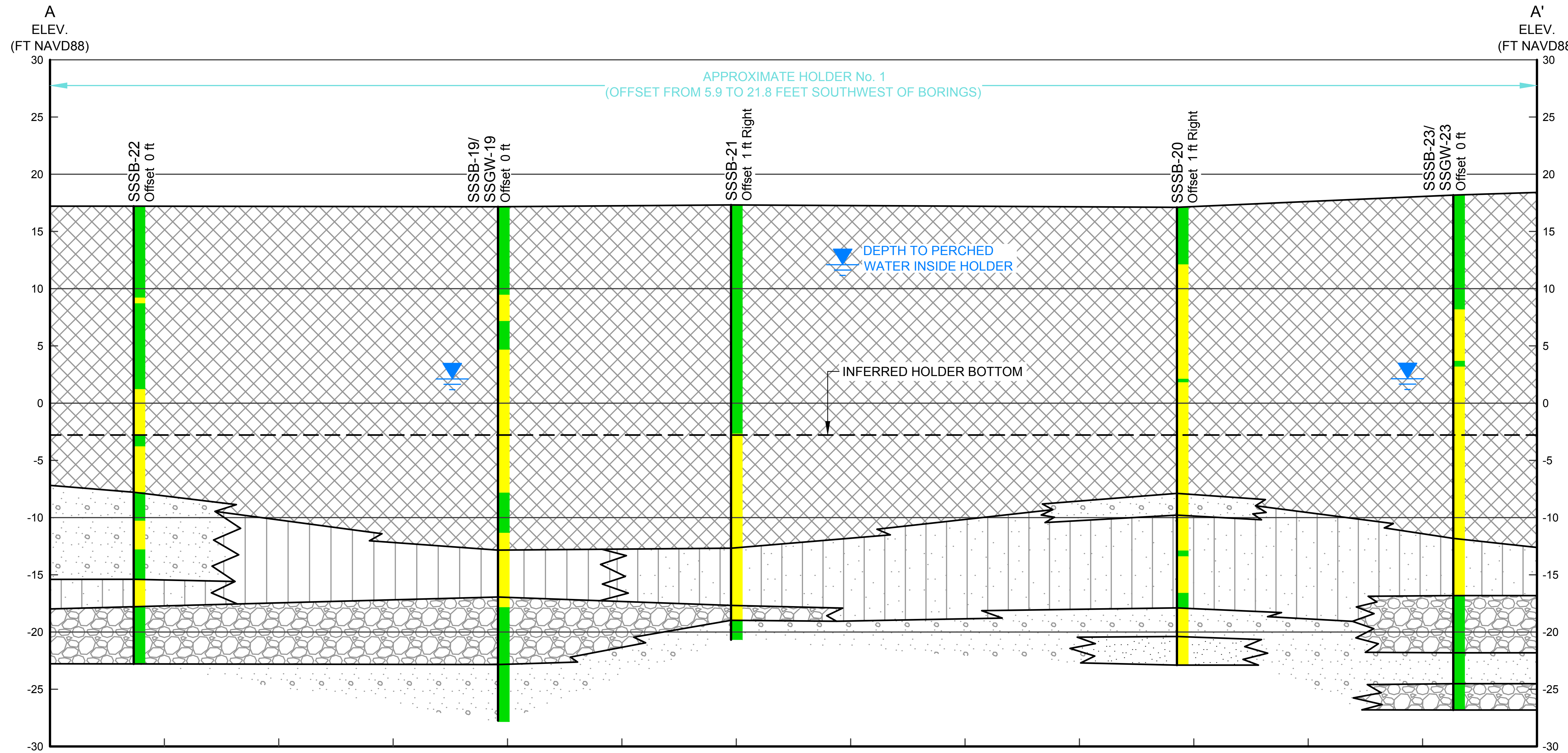

HORIZONTAL SCALE: 1" = 5'

0 5 10

0 10 20

VERTICAL SCALE: 1" = 10'

NOTE: 0.5xVERTICAL EXAGGERATION

LEGEND

SSSB-19/ SSGW-19 — SOIL BORING/TEMPORARY MONITORING WELL IDENTIFICATION

MEASURED GROUNDWATER TABLE PRIOR TO SAMPLING

NAVD88 — NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

- FILL
- SAND
- SANDY SILT
- SAND WITH GRAVEL
- SILTY SAND
- GRAVEL

PHYSICAL OBSERVATIONS

- NO PHYSICAL IMPACTS
- STAINING, ODORS

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744 Bedford Avenue
Former Skillman Street Holder Station Site
Brooklyn, New York

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CROSS SECTION A-A'

Project 093080	April 2016	Fig. 2

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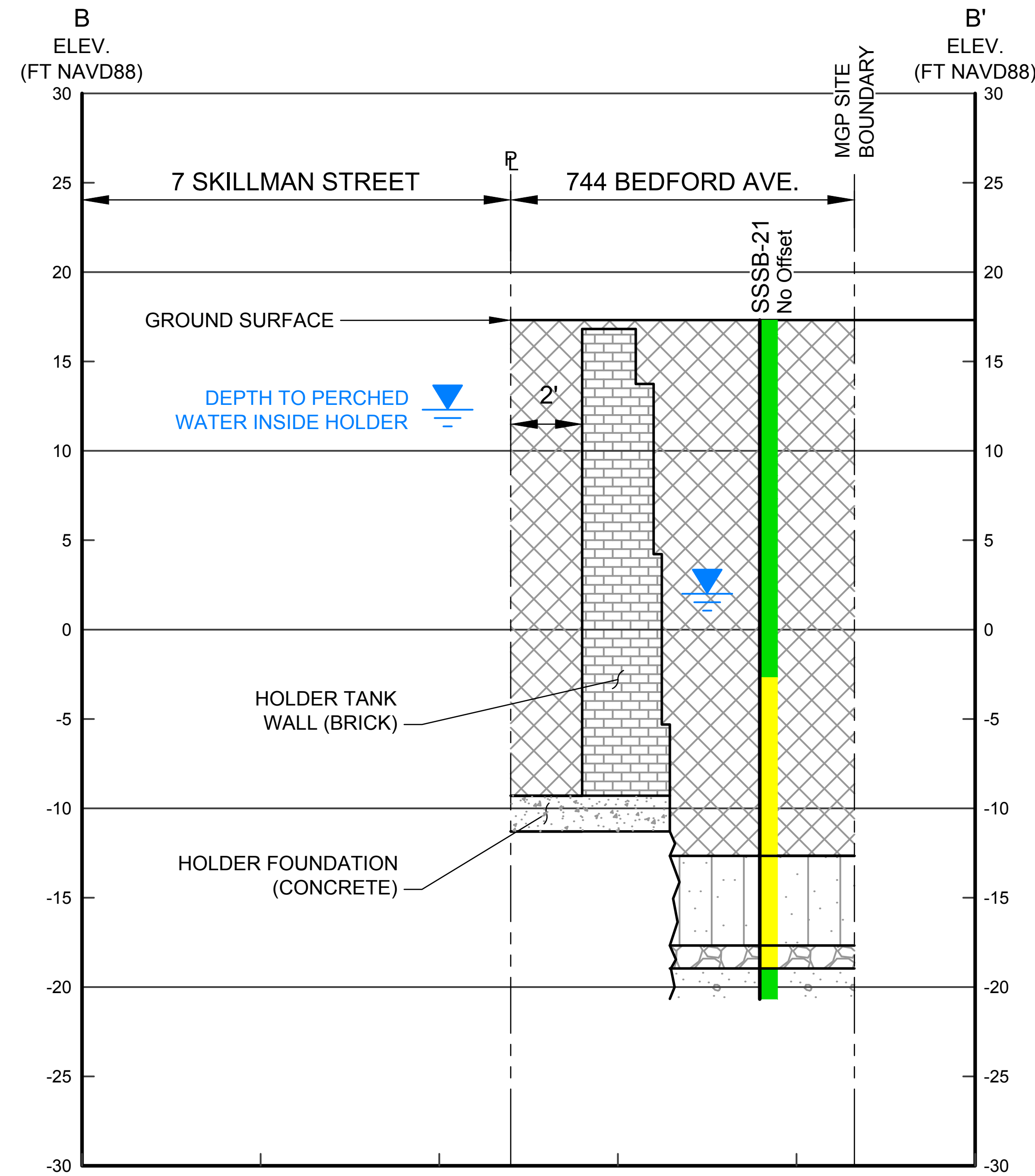

HORIZONTAL SCALE: 1" = 5'

0 5 10

0 10 20

VERTICAL SCALE: 1" = 10'

NOTE: 0.5xVERTICAL EXAGGERATION

NOTE:

1. HOLDER FOUNDATION AND WALL PROFILE ESTIMATED BASED ON THE FOLLOWING SOURCES: (1) TEST PIT CONDUCTED ON MARCH 8, 2016, (2) THE BROOKLYN UNION GAS CO. DRAWING TITLED, "DIAGRAM OF HOLDERS SHEET 3, DRAWING NUMBER 6-B-50, DATED DECEMBER 22, 1913, (3) GAS HOLDER INFORMATION DATED DECEMBER 31, 1920, PROVIDED BY NATIONAL GRID.

DRAFT

LEGEND

SSSB-19/ SSGW-19 — SOIL BORING/TEMPORARY MONITORING WELL IDENTIFICATION

MEASURED GROUNDWATER TABLE PRIOR TO SAMPLING

NAVD88 — NORTH AMERICAN VERTICAL DATUM (1988)

GEOLOGY

- FILL
- SAND
- SANDY SILT
- SAND WITH GRAVEL
- SILTY SAND
- GRAVEL

PHYSICAL OBSERVATIONS

- NO PHYSICAL IMPACTS
- STAINING, ODORS

744 Bedford Avenue Former Skillman Street Holder Station Site Brooklyn, New York	GEI Consultants	CROSS SECTION B-B'
nationalgrid	Project 093080	April 2016 Fig. 3

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GEI Consultants, Inc. P.C. 455 Winding Brook Drive Suite 201 Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 1 of 2 — SSSB-19

GROUND SURFACE ELEVATION (FT): 17.16 **LOCATION:** Adjacent to and east of Holder 1
NORTHING (FT): 679789 **EASTING (FT):** 642570 **TOTAL DEPTH (FT):** 45.0
DRILLED BY: Danny Ninevski **DATUM VERT. / HORZ.:** NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz **DATE START / END:** 3/11/2016 - 3/11/2016
DRILLING DETAILS: Sonic Coring / Compact Roto Sonic
WATER LEVEL DEPTHS (FT): ▼ 15.00 3/11/2016 12:20 pm
GENERAL NOTE: Temporary GW point, SSSB-19 (14-24), installed and sampled on 3/11/16

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	0	S-1	5/2.3						(0'- 0.8') CONCRETE.
15				0.0					(0.8'- 3') SILTY SAND (SM); ~80% sand, fine to medium, ~15% fines, ~5% gravel, fine to coarse; max. size 1, moist to wet, dark brown to brown, FILL.
				0.0					
				0.1					(3'- 5') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; moist, red brown, coarse brick @ 3', FILL.
	5	S-2	5/3.7						(5'- 7.7') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse; max. size 1, moist, brown, FILL.
				0.0					
10				0.0					
				0.0			NLO	SSSB-19 (7.5-8.5) and a duplicate JHS = 0.0 SSSB-19 GRAB 1	(7.7'- 10') SILTY SAND (SM); ~60% sand, fine, ~30% fines, ~10% gravel, fine to coarse; max. size 1.25, slight naphthalene-like odor, moist, brown, brick fragments @ 7.7 - 8.3', trace coal fragments, FILL.
				0.0					
	10	S-3	5/2						(10'- 11.3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moist, brown, FILL.
				0.0					(11.3'- 12.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine to coarse, ~10% fines; max. size 3, moist, brown, FILL.
5				0.0			NLO	SSSB-19 GRAB 5	
				0.0				SSSB-19 (13.5-15) SSSB-19 GRAB 2	(12.5'- 15') SANDY SILT (ML); ~60% fines, ~30% sand, fine to medium, ~10% gravel, fine to coarse; max. size 1, slight naphthalene-like odor, moist, brown, FILL.
▼	15	S-4	5/1.4						(15'- 18.5') WIDELY GRADED GRAVEL WTH SAND (GW); ~65% gravel, fine to coarse, ~30% sand, fine to medium, ~5% fines; max. size 2, slight naphthalene-like odor, wet, brown, cobble @ 18.5', FILL.
0				0.0			NLO		
				0.0			NLO	JHS = 1.8	(18.5'- 20') WIDELY GRADED GRAVEL WTH SAND (GW); ~65% gravel, fine to coarse, ~30% sand, fine to coarse, ~5% fines; max. size 2, slight naphthalene-like odor, wet, white, thin layer of blue-green f-m sand @ 18.5' with moderate NLO, FILL.
	20	S-5	5/2.8				NLO		(20'- 21.4') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, ~5% fines; max. size 2, slight naphthalene-like odor, wet, brown, FILL.
-5				0.0			NLO		
				0.0			NLO		(21.4'- 22.5') WIDELY GRADED GRAVEL WTH SAND (GW); ~70% gravel, fine to coarse, ~30% sand,

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (PPM)
JHS = JAR HEADSPACE PID READING (PPM)

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc. P.C. 455 Winding Brook Drive Suite 201 Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 2 of 2 SSSB-19

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				0.0	NLO	JHS = 5.0	fine to medium; max. size 2, slight naphthalene-like odor, wet, brownish red, FILL.
	25	S-6	5/4	0.0		SSSB-19 GRAB 3	(22.5'- 25') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse; max. size 0.75, slight naphthalene-like odor, dry, brown, thin intermittent portions of gray staining, 2-inch concrete @ 28.2', moderate NLO below, FILL.
-10				0.0	MLO	JHS = 1.5	(25'- 26.75') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, brown, FILL.
				0.0			(26.75'- 28.1') WIDELY GRADED GRAVEL WTH SAND (GW); ~70% gravel, fine to coarse, ~30% sand, fine to coarse; max. size 3, slight musty-like odor, wet, brown, FILL.
				0.0	NLO		(28.1'- 28.5') COBBLE; FILL.
	30	S-7	5/3.8	0.4			(28.5'- 30') SILT WITH GRAVEL (ML); ~55% fines, ~25% gravel, fine to coarse, ~20% sand, fine to medium; max. size 2, slight naphthalene-like odor, dry, dark gray to brown, slight chemical-like odor, FILL.
-15				0.4	NLO		
				1.0		SSSB-19 GRAB 4	(30'- 34.1') SANDY SILT (ML); ~50% fines, ~35% sand, fine to medium, ~15% gravel, fine to coarse; slight naphthalene-like odor, dry to moist, brown, moderate NLO with depth.
				2.6	NLO	SSSB-19 (33-34) JHS = 2.0	(34.1'- 35') WIDELY GRADED GRAVEL (GW); ~80% gravel, fine to coarse, ~15% sand, fine to coarse, ~5% fines; max. size 1, strong naphthalene-like odor, wet, gray brown, odor increases with depth.
	35	S-8	5/1.5				(35'- 40') WIDELY GRADED GRAVEL (GW); ~80% gravel, fine to coarse, ~20% sand, fine to coarse; max. size 3, wet, brown.
-20				0.0			
				0.0			
	40	S-9	5/1				(40'- 45') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel, fine to coarse; max. size 2, wet, brown.
-25				0.0		JHS = 0.3	
	45						End of Boring at 45 feet. Tremie grout from bottom to top.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (PPM)
JHS = JAR HEADSPACE PID READING (PPM)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

GEI Consultants, Inc. P.C.
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Suite 201
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CLIENT:	National Grid
PROJECT:	Skillman Street Holder Station
CITY/STATE:	Brooklyn, New York
GEI PROJECT NUMBER:	093080-1-1101

BORING LOG

SSSB-20

GROUND SURFACE ELEVATION (FT): 17.11
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679759 **EASTING (FT):** 642574
TOTAL DEPTH (FT): 40.0
DRILLED BY: William Shinn
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/10/2016 - 3/10/2016
DRILLING DETAILS: Sonic Coring / Small Roto Sonic
WATER LEVEL DEPTHS (FT):
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
15	0		5/NM	NA		JHS = 2.6
10	5	S-1	5/3	0.0, 0.0, 0.0, 0.0	NLO	JHS = 132.4 SSSB-20 GRAB 1
5	10	S-2	5/4.6	0.0, 0.0, 0.0, 0.0	NLO, NLO, NLO	JHS = 3.8
0	15	S-3	5/4.9	0.0, 0.0, 0.0, 0.0	NLO, NLO, NLO	JHS = 3 SSSB-20 GRAB 2
-5	20	S-4	5/3.3	0.0, 0.0, 0.0	NLO, NLO, NLO, NLO	JHS = 2.2

SOIL / BEDROCK DESCRIPTION

(0'- 0.8') CONCRETE.

(0.8'- 5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% sand, fine to medium, ~25% gravel, fine to coarse, ~10% fines; dry to moist, brown to red brown, bricks, concrete, cobbles, hand cleared.

(5'- 10') SILTY SAND (SM); ~75% sand, fine, ~20% fines, ~5% gravel, fine to coarse; max. size 1.5, slight naphthalene-like odor, wet, brown, black stained wood chips with strong NLO @ 8.2', moderate NLO to 10'.

(10'- 12.4') SILTY SAND (SM); slight naphthalene-like odor, moist, same as above.

(12.4'- 13.8') SILTY SAND (SM); slight naphthalene-like odor, moist, brown gray, 3-inch cobble @ 12.5', 1/8-inch layer of gray staining @ 13.6'.
(13.8'- 15') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~35% fines, ~15% gravel, fine to coarse; max. size 1.5, slight naphthalene-like odor, moist, brown.
(15'- 15.3') COBBLE.
(15.3'- 18.5') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~35% fines, ~15% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, moist to wet, brown, 3-inch cobble @ 17.5'.
(18.5'- 19') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~25% gravel, fine to coarse, ~25% fines; max. size 2, slight naphthalene-like odor, wet, dark gray stained.
(19'- 20') SILTY SAND (SM); ~75% sand, fine to coarse, ~15% fines, ~10% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, wet, brown gray.
(20'- 21.5') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW); ~60% sand, fine to coarse, ~30% gravel, fine to coarse, ~10% fines; max. size 3, slight

NOTES:

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JHS = JAR HEADSPACE PID READING (PPM)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

GEI Consultants, Inc. P.C. 455 Winding Brook Drive Suite 201 Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 2 of 2 **SSSB-20**

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				0.0			NLO	SSSB-20 (23-24.5)	naphthalene-like odor, wet, gray brown.
	25	S-5	5/1.8				NLO		(21.5'- 21.7') SANDY SILT (ML); ~60% fines, ~35% sand, fine, ~5% gravel, fine; slight naphthalene-like odor, wet, red brown.
-10				0.0			NLO	SSSB-20 GRAB 3	(21.7'- 23.5') SANDY SILT (ML); ~65% fines, ~25% sand, fine to medium, ~10% gravel, fine to coarse; max. size 0.5, slight naphthalene-like odor, wet, brown gray.
				0.0			NLO	JHS = 4.5	(23.5'- 24.1') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~85% sand, fine, ~15% gravel, fine to coarse, ~10% fines; max. size 1, slight naphthalene-like odor, moist, brown, layer of blue-green fine to medium sand.
	30	S-6	5/1.5	2.1					(24.1'- 25') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 0.5, slight naphthalene-like odor, dry, red brown to gray, 3-inch cobble @ 24.8'.
-15				15.8			NLO	SSSB-20 GRAB 4 JHS = 150.2	(25'- 26.9') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; max. size 1, slight naphthalene-like odor, wet, brown gray.
				0.7				SSSB-20 (33-34)	(26.9'- 27.8') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse; max. size 3, slight naphthalene-like odor, wet, gray.
	35	S-7	5/1				NLO		(27.8'- 30') SILTY SAND (SM); ~75% sand, fine to medium, ~20% fines, ~5% gravel, fine to coarse; max. size 1, slight naphthalene-like odor, wet, brown gray, 1/4-inch layer of black soil @ 27.8'.
-20				0.2					(30'- 30.5') COBBLE.
				4.2			NLO	JHS = 7.8	(30.5'- 33.7') SILT WITH SAND (ML); ~70% fines, ~20% sand, fine, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, brown.
	40								

(33.7'- 35') SILT WITH GRAVEL (ML); ~75% fines, non plastic, ~20% gravel, fine to coarse, ~5% sand, medium; max. size 2, wet, red brown.
(35'- 37.5') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, coarse, ~5% fines; max. size 2, slight naphthalene-like odor, wet, brown.
(37.5'- 40') NARROWLY GRADED SAND (SP); ~95% sand, medium to coarse, ~5% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, wet, brown.
End of Boring at 40 feet.
Tremie grout from bottom to top.

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IN. = INCHES
FT. = FEET

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TLO = TAR LIKE ODOR
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CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc. P.C. 455 Winding Brook Drive Suite 201 Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 1 of 2 SSSB-21

GROUND SURFACE ELEVATION (FT): 17.32 **LOCATION:** Adjacent to and east of Holder 1
NORTHING (FT): 679779 **EASTING (FT):** 642571 **TOTAL DEPTH (FT):** 38.0
DRILLED BY: William Shinn **DATUM VERT. / HORZ.:** NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz **DATE START / END:** 3/9/2016 - 3/9/2016
DRILLING DETAILS: Sonic Coring / Small Roto Sonic
WATER LEVEL DEPTHS (FT):
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	0		5/NM				CONCRETE.
15				NA		JHS = 0.9	(0.8'- 2') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, ~5% fines; max. size 2, dry, brown, bricks, concrete, cobbles, hand cleared, FILL. (2'- 5') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, ~5% fines; max. size 2, dry to moist, brown dark brown, fewer bricks, concrete, cobbles, hand cleared, FILL.
	5	S-1	5/2.6	0.0			(5'- 7.9') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, ~5% fines; max. size 1, wet, brown, FILL.
10				0.1			
				0.0			(7.9'- 8.7') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; moist, light gray, FILL.
				0.0		JHS = 1.4 SSSB-21 GRAB 1	(8.7'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, ~5% fines; max. size 1, wet, brown, brick fragments, FILL.
	10	S-2	5/0.5				(10'- 15') NARROWLY GRADED SAND WITH GRAVEL (SP); ~50% sand, fine to medium, ~45% gravel, coarse, ~5% fines; wet, brown, 2.5-inch rock encapsulated by the sand, poor recovery, FILL.
5				0.0		JHS = 1.2	
				0.0			
	15	S-3	5/0.9				(15'- 20') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, ~5% fines; wet, brown, 2.5-inch rock at 15', poor recovery, FILL.
0				0.0			
				0.0		SSSB-21 GRAB 2	
	20	S-4	5/3.6		NLO	JHS = 1.4	(20'- 21.25') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~65% sand, fine to coarse, ~25% gravel, fine to coarse, ~10% fines; max. size 3, slight naphthalene-like odor, wet, brown gray, FILL.
				0.1	NLO	SSSB-21 (21.5-22) JHS = 9.4	(21.25'- 21.8') WIDELY GRADED SAND WITH GRAVEL (SW); ~65% sand, fine to coarse, ~25% gravel, fine to coarse, ~5% fines; max. size 2,
-5				0.1	NLO		moderate naphthalene-like odor, wet, gray brown,
				0.4	NLO		

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(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-21

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
				0.4	NLO	SSSB-21 GRAB 3 JHS = 12.5
	25	S-5	5/0.7	0.8		
				0.5	NLO	
-10				0.7	NLO	
	30	S-6	5/3.8	4.1		JHS = 188
-15				9.6	NLO	
				3.3		
				0.9		
	35	S-7	3/1.3	0.3	NLO	
-20				0.3		SSSB-21 GRAB 4

SOIL / BEDROCK DESCRIPTION

FILL.
(21.8'- 23.5') SILTY SAND (SM); ~65% sand, fine to medium, ~25% fines, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, brown gray, brick fragments, FILL.
(23.5'- 24.2') SILTY SAND (SM); ~65% sand, fine to medium, ~25% fines, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, dark gray to black stained, FILL.
(24.2'- 25') SILTY SAND (SM); ~65% sand, fine to medium, ~25% fines, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, brown gray, FILL.
(25'- 27.1') SILTY SAND (SM); ~80% sand, fine to coarse, ~15% fines, ~5% gravel, fine; max. size 0.25, moderate naphthalene-like odor, wet, brown gray, FILL.
(27.1'- 30') SILTY SAND (SM); ~70% sand, fine to coarse, ~15% gravel, fine to coarse, ~15% fines; max. size 0.5, moderate naphthalene-like odor, wet, brown gray, slight black staining, FILL.
(30'- 35') SILTY SAND (SM); ~55% sand, fine to medium, ~35% fines, ~10% gravel, fine to coarse; max. size 2, moderate naphthalene-like odor, wet, brown.
(35'- 36.3') WIDELY GRADED SAND WITH GRAVEL (SW); ~60% sand, fine to coarse, ~40% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, wet, brown.
(36.3'- 38') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, medium to coarse, ~20% gravel, fine to coarse; wet, gray.
End of Boring at 38 feet.
Tremie grout from bottom to top.

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CLIENT:	National Grid
PROJECT:	Skillman Street Holder Station
CITY/STATE:	Brooklyn, New York
GEI PROJECT NUMBER:	093080-1-1101

BORING LOG

SSSB-22

GROUND SURFACE ELEVATION (FT): 17.21
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679804 **EASTING (FT):** 642567
TOTAL DEPTH (FT): 40.0
DRILLED BY: William Shinn
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/10/2016 - 3/10/2016
DRILLING DETAILS: Sonic Coring / Small Roto Sonic
WATER LEVEL DEPTHS (FT):
GENERAL NOTE:

ELEV. FT.: 15, 10, 5, 0, -5

DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
0		5/NM			
5	S-1	5/3	NA		
			0.5		
			0.1		JHS = 2.9 SSSB-22 GRAB 1
10	S-2	3/2.2	0.0		
			0.0		
			0.0		
	S-3	1/1.7	0.1		JHS = 0.0
	S-4	1/1.5	0.1		
15	S-5	5/3.6	0.1	NLO	
			0.1		
			0.1	NLO	JHS = 0.9 SSSB-22 GRAB 2
			0.1		
			0.1	NLO	JHS = 0.4
20	S-6	5/1.7			
			0.0		SSSB-22 (20-23)
				NLO	
			0.0	NLO	JHS = 0.3

SOIL / BEDROCK DESCRIPTION

(0'- 0.8') CONCRETE.

(0.8'- 2.5') SILTY SAND (SM); ~50% sand, fine to medium, ~40% fines, ~10% gravel, fine to coarse; max. size 2, dry, brown reddish brown, bricks, concrete, cobbles, hand cleared, FILL.
(2.5'- 5') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse; moist, reddish brown dark brown, coal fragments, hand cleared, FILL.

(5'- 8') SILTY SAND (SM); ~75% sand, fine to medium, ~20% fines, ~5% gravel, fine to coarse; max. size 1, wet, brown, FILL.

(8'- 8.5') SILTY SAND (SM); black stained, same as 5-8', FILL.
(8.5'- 10') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 1, wet, brown gray, FILL.
(10'- 13') SILTY SAND (SM); same as 8.5-10', max size 1.5-inches, FILL.

(13'- 13.5') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, coarse, ~5% fines; max. size 1, wet, brown gray, FILL.
(13.5'- 14') CONCRETE.
(14'- 15') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine, ~5% fines; wet, brown gray, 3-inch cobble at 15', FILL.
(15'- 16.4') NARROWLY GRADED SAND WITH GRAVEL (SP); ~65% sand, fine to medium, ~30% gravel, fine to coarse, ~5% fines; max. size 2, wet, brown gray, a few 3-inch cobbles, FILL.
Slight naphthalene-like odor, 0.25-inch black stain @ 16', FILL.
(16.4'- 18.9') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to medium, ~35% gravel, fine to coarse, ~15% fines; max. size 2.5, slight naphthalene-like odor, moist, red brown and gray, brick at ~18', FILL.
(18.9'- 20') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine to medium, ~15% gravel, fine to coarse, ~15% fines; max. size 1, slight naphthalene-like odor,

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Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

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CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-22

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID
				0.0			NLO	
	25	S-7	5/4.8	0.0				
-10				0.0				SSSB-22 GRAB 3
				0.0			NLO	
				0.0				JHS = 0.3
	30	S-8	5/3.1	0.0				
-15								SSSB-22 GRAB 4
				0.0			NLO	
				0.0				
	35	S-9	5/0.5					JHS = 0.1
-20				0.0				
	40							

SOIL / BEDROCK DESCRIPTION

moist, brown gray, brick fragments, FILL.
(20'- 21') COBBLE; FILL.
(21'- 23') NARROWLY GRADED SAND WITH GRAVEL (SP); ~55% sand, fine to medium, ~40% gravel, fine to coarse, ~5% fines; max. size 2.5, slight naphthalene-like odor, wet, gray, FILL.
(23'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine, ~10% fines; slight naphthalene-like odor, wet, brown, FILL.
(25'- 27.5') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% gravel, fine to coarse, ~15% fines; max. size 2, wet, brown gray.
(27.5'- 30') SILTY SAND WITH GRAVEL (SM); slight naphthalene-like odor, same as 25-27.5'.
(30'- 31.8') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~25% gravel, fine to coarse, ~15% fines; max. size 2, wet, brown.
(31.8'- 32.6') SILTY SAND (SM); ~75% sand, fine to coarse, ~15% fines, ~10% gravel, fine to coarse; max. size 2, wet, brown.
(32.6'- 35') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; slight naphthalene-like odor, wet, brown to reddish gray, cobbles.
(35'- 40') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse; max. size 2, wet, gray, 7 rocks recovered.

End of Boring at 40 feet.
Tremie grout from bottom to top.

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PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
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GEI Consultants, Inc. P.C. 455 Winding Brook Drive Suite 201 Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 1 of 2 **SSSB-23**

GROUND SURFACE ELEVATION (FT): 18.18
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679748 **EASTING (FT):** 642577
TOTAL DEPTH (FT): 45.0
DRILLED BY: Danny Ninevski
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/10/2016 - 3/11/2016
DRILLING DETAILS: Sonic Coring / Compact Roto Sonic
WATER LEVEL DEPTHS (FT): ▼ 17.00 3/11/2016 7:45 am
GENERAL NOTE: Temporary GW point, SSSB-23 (15-25), installed and sampled on 3/10/16

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
	0		5/NM			
15						
	5	S-1	5/3.9	NA 0.0 0.0 0.1 0.1		SSSB-23 GRAB 1 JHS = 1.2
10						
	10	S-2	5/4.2	0.1 0.1 0.0 0.0	NLO NLO NLO	SSSB-23 GRAB 5 SSSB-23 GRAB 2
5						
	15	S-3	5/4.2	0.1 0.1 1.7 1.4	NLO NLO	JHS = 0.4
0						
	20	S-4	5/2	0.7 1.3	NLO	JHS = 2.3
-5						

SOIL / BEDROCK DESCRIPTION

(0'- 0.8') CONCRETE.

(0.8'- 5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% sand, fine to medium, ~25% gravel, fine to coarse, ~10% fines; dry to moist, brown to red brown, bricks, concrete, cobbles, hand cleared, FILL.

(5'- 5.4') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, dark gray, 3-inch chunk of metal, FILL.
(5.4'- 6.4') SILT (ML); ~95% fines, non plastic, ~5% sand, fine; wet, gray to light brown, plastic fragments, FILL.
(6.4'- 7.3') SILT (ML); ~90% fines, non plastic, ~5% gravel, fine to coarse, ~5% sand, fine to medium; max. size 1, wet, light brown, FILL.
(7.3'- 10') SANDY SILT (ML); ~60% fines, ~30% sand, fine to medium, ~10% gravel, fine to coarse; max. size 1, moist, brown, FILL.
(10'- 10.8') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse; max. size 1.5, slight naphthalene-like odor, moist, brown, slight chemical-like odor, FILL.
(10.8'- 11.9') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, wet, brown to gray stained, FILL.
(11.9'- 14.5') SILTY SAND (SM); ~60% sand, fine to medium, ~30% fines, ~10% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, moist, dark brown, 2-inch red gravel @ 14', FILL.
(14.5'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; dry, light gray, coarse rock at 15', FILL.
(15'- 16') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine to medium, ~15% gravel, fine to coarse, ~15% fines; max. size 1.5, slight naphthalene-like odor, wet to moist, brown gray, FILL.
(16'- 20') SILT WITH SAND (ML); ~70% fines, ~20% sand, fine, ~10% gravel; max. size 3, slight naphthalene-like odor, moist, red brown to gray, layer of gray widely graded sand with f-c gravel (25%) and 5 % fines @ 17.6 - 17.9', slight to moderate NLO, FILL.
(20'- 24') SILT WITH SAND (ML); moderate

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (PPM)
JHS = JAR HEADSPACE PID READING (PPM)

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc. P.C.
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

SSSB-23

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				0.2					naphthalene-like odor, same as above, FILL. (24'- 25') CONCRETE; FILL.
	25	S-5	5/3.2	0.0			NLO		(25'- 27.3') WIDELY GRADED GRAVEL WITH SAND (GW); ~60% gravel, fine to coarse, ~35% sand, fine to coarse, ~5% fines; max. size 1.5, slight naphthalene-like odor, wet, brown, loose, FILL.
				0.0				JHS = 0.0 SSSB-23 GRAB 3 SSSB-23 GRAB 6	
-10				0.0			NLO		(27.3'- 30') SILTY SAND (SM); ~60% sand, fine to medium, ~20% gravel, fine to coarse, ~20% fines; max. size 1, slight naphthalene-like odor, dry, brown gray to dark gray, intermittent presence of dark red fine sand, brick fragments, FILL.
				0.0					
	30	S-6	5/4.9	0.0					(30'- 34') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to medium, ~35% fines, ~15% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, moist, brown gray, FILL.
				0.0			NLO		
-15				2.0				SSSB-23 (32.5-33.5) JHS = 0.0 SSSB-23 GRAB 4 and GRAB 7	
				7.1					
				1.3			NLO		(34'- 35') SILTY SAND (SM); ~50% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 1, slight naphthalene-like odor, moist, brown.
	35	S-7	5/0.8						(35'- 40') WIDELY GRADED GRAVEL (GW); ~95% gravel, fine to coarse, ~5% sand, fine to coarse; max. size 3, wet, gray.
-20				0.0					
	40	S-8	5/1.5						(40'- 42.7') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; max. size 1.5, wet, brown.
				0.0					
-25				0.0					(42.7'- 45') WIDELY GRADED GRAVEL WITH SAND (GW); ~80% gravel, fine to coarse, ~20% sand, fine to coarse; max. size 3, wet, brown.
	45								

End of Boring at 45 feet.
Tremie grout from bottom to top.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (PPM)
JHS = JAR HEADSPACE PID READING (PPM)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
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NLO = NAPHTHALENE LIKE ODOR
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CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

BORING INFORMATION

LOCATION: Adjacent to and east of Holder 1

GROUND SURFACE EL. (ft): 17.11 **DATE START/END:** 3/10/2016 - 3/10/2016

VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

TOTAL DEPTH (ft): 37.0 **DRILLER NAME:** William Shinn

LOGGED BY: Drew Blicharz **RIG TYPE:**

BORING SSSB-20

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ 6.5 inch **CORE BARREL TYPE:**

AUGER I.D/O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 3.5 inch / NA

DRILLING METHOD: Sonic Drilling

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
						Hand cleared to 5 feet bgs. See environmental boring log.		
	5					Sonic soil sample collected 5-10 feet bgs. See environmental boring log.		
7	10					Sonic soil sample collected 10-15 feet bgs. See environmental boring log.		
	15					Sonic soil sample collected 15-20 feet bgs. See environmental boring log. Sonic soil samples collected after split spoon samples 20-40 feet bgs. See environmental boring log.		
-3	20	S1	20 to 22	24/17	8-13-22-30	PID = 0.0, 0.0, 0.0		S1A (0-8"): NARROWLY GRADED SAND WITH GRAVEL (SP); ~55% f-m sand, ~40% f-c gravel up to 1", ~5% silt, brown-gray, wet. Slight naphthalene-like odor. S1B (8-14"): NARROWLY GRADED SAND WITH GRAVEL (SP); similar to S1A (0-8") with a 0.25" layer of white medium sand, reddish-gray. Slight naphthalene-like odor. S1C (14-16"): NARROWLY GRADED SAND WITH GRAVEL (SP); similar to S1A (0-8"), dark brown to gray. Slight

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

LOCATION: Adjacent to and east of Holder 1			**BORING SSSB-20**
GROUND SURFACE EL. (ft): 17.11	**DATE START/END:** 3/10/2016 - 3/10/2016		
VERTICAL DATUM: NAVD 88	**DRILLING COMPANY:** Summit Drilling		**PAGE 2 of 2**

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
								naphthalene-like odor.
	25	S2	25 to 27	24/8	9-11-16-24	PID = 0.0		S2A (0-3"): NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~75% f-m sand, ~15% fine gravel, ~10% silt, brown-gray, wet. Slight naphthalene-like odor. S2B (3-7"): WIDELY GRADED GRAVEL (GW); ~90% f-c gravel up to 1", ~5% f sand, ~5% silt, red, wet. S2C (7-8"): NARROWLY GRADED SAND (SP); ~95% f-m sand, ~5% silt, dark gray to gray, wet. Slight naphthalene-like odor.
-13	30	S3	30 to 30.2	2/0	50/2			S3: NO RECOVERY.
	35	S4	35 to 37	24/3	20-24-21-24	PID = 0.0, 0.0		S4 (0-3"): WIDELY GRADED GRAVEL (GW); ~100% f-c gravel up to 1", gray, wet.
								Bottom of boring at depth of ~37.0' below grade - planned extent of borehole. Summit tremie-grouted the hole upon completion of the boring.
-23	40							
	45							
-33	50							
	55							

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

BORING INFORMATION

LOCATION: Adjacent to and east of Holder 1

GROUND SURFACE EL. (ft): 17.32 | **DATE START/END:** 3/9/2016 - 3/9/2016

VERTICAL DATUM: NAVD 88 | **DRILLING COMPANY:** Summit Drilling

TOTAL DEPTH (ft): 35.2 | **DRILLER NAME:** William Shinn

LOGGED BY: Drew Blicharz | **RIG TYPE:**

BORING SSSB-21

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** NA/ 6.5 inch | **CORE BARREL TYPE:**

AUGER I.D/O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** 3.5 inch / NA

DRILLING METHOD: Sonic Drilling

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	0					Hand cleared to 5 feet bgs. See environmental boring log.		
	5					Sonic soil sample collected 5-10 feet bgs. See environmental boring log.		
7	10	S1	10 to 12	24/8	3-4-3-3	PID = 0.0, 0.0		S1: NARROWLY GRADED SAND (SP); ~95% f-m sand, ~5% silt, brown, wet, FILL.
						Sonic soil samples collected after split spoon samples 10-38 feet bgs. See environmental boring log.		
	15	S2	15 to 17	24/9	7-13-11-4	PID = 0.0, 0.0		S2A (0-2"): WIDELY GRADED GRAVEL WITH SAND (GW); ~85% f-c gravel up to 0.75", ~15% sand, red, wet, FILL. S2B (2-9"): NARROWLY GRADED SAND (SP); ~85% f-m sand, ~10% f-c gravel up to 1", ~5% fines, brown, wet, FILL.
-3	20	S3	20 to 21.9	23/14	8-7-8-50/5	PID = 0.0, 0.0		S3A (0-3"): WIDELY GRADED SAND WITH GRAVEL (SW); ~75% f-c sand, ~20% f-c gravel up to 0.5", ~5% silt, brown-gray, wet, FILL. Slight petroleum-like odor. S3B (3-8"): WIDELY GRADED GRAVEL WITH SAND (GW); ~65% f-c gravel up to 1", ~30% f-c sand,~5% silt, red and brown, wet, FILL. S3C (8-14"): WIDELY GRADED SAND WITH GRAVEL (SW); ~90% f-c sand, ~5% fine gravel, ~5% silt, brown, wet, FILL.

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

LOCATION: Adjacent to and east of Holder 1
GROUND SURFACE EL. (ft): 17.32 **DATE START/END:** 3/9/2016 - 3/9/2016
VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	25	S4	25 to 27	24/16	8-14-17-29	PID = 0.6, 0.6, 1.0		S4A (0-11"): NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% f-m sand, ~10% silt, ~5% f-c gravel up to 0.5", brown-gray, moist to wet. A 1" black stained layer 0.7'. Slight naphthalene-like odor. S4B (11-16"): NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% f-m sand, ~10% f-c gravel up to 0.5", ~10% silt, brown to brown-gray, moist to wet. Slight naphthalene-like odor.
-13	30	S5	30 to 32	24/16	8-16-19-30	PID = 2.0, 1.0, 9.2		S5: SILTY SAND WITH GRAVEL (SM); ~65% f-m sand, ~20% f-c gravel up to 1", ~15% silt, brown, wet. Moderate naphthalene-like odor.
	35	S6	35 to 35.2	2/0	50/2			S6: NO RECOVERY. Bottom of boring at depth of ~35.2' below grade where refused. Summit tremie-grouted the hole upon completion of the boring.
-23	40							
	45							
-33	50							
	55							

NOTES:

PROJECT NAME: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

BORING INFORMATION

LOCATION: Adjacent to and east of Holder 1

GROUND SURFACE EL. (ft): 17.21 **DATE START/END:** 3/10/2016 - 3/10/2016

VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

TOTAL DEPTH (ft): 40.0 **DRILLER NAME:** William Shinn

LOGGED BY: Drew Blicharz **RIG TYPE:**

BORING SSSB-22

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ 6.5 inch **CORE BARREL TYPE:**

AUGER I.D/O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 3.5 inch / NA

DRILLING METHOD: Sonic Drilling

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:

Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	0					Hand cleared to 5 feet bgs. See environmental boring log.		
	5					Sonic soil sample collected 5-10 feet bgs. See environmental boring log.		
7	10					Sonic soil sample collected 10-15 feet bgs. See environmental boring log.		
	15					Sonic soil sample collected 15-20 feet bgs. See environmental boring log. Sonic soil samples collected after split spoon samples 20-40 feet bgs. See environmental boring log.		
-3	20	S1	20 to 20.9	11/1	18-50/5	PID = 0.1		S1: NARROWLY GRADED SAND (SP); ~95% f-m sand, ~5% silt, brown, wet.

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

LOCATION: Adjacent to and east of Holder 1
GROUND SURFACE EL. (ft): 17.21 **DATE START/END:** 3/10/2016 - 3/10/2016
VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

BORING SSSB-22

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	25	S2	25 to 27	24/12	11-11-15-23	PID = 0.0, 0.0		S2: SILTY SAND (SM); ~80% f-m sand, ~15% silt, ~5% f-c gravel up to 1.5", brown to reddish-brown, wet.
-13	30	S3	30 to 31.4	17/5	13-11-50/5	PID = 0.0		S3: WIDELY GRADED SAND WITH GRAVEL (SW); ~75% f-c sand, ~20% f-c gravel up to 1", ~5% silt, brown-gray, wet.
	35	S4	35 to 37	24/5	10-10-9-22	PID = 0.0		S4: WIDELY GRADED SAND (SW); ~85% f-c sand, ~10% f-c gravel up to 1", ~5% silt, dark gray, wet.
-23	40	S5	40 to 40	0/0	REF			Bottom of boring at depth of ~40.0' below grade where refused. Summit tremie-grouted the hole upon completion of the boring.
	45							
-33	50							
	55							

NOTES:

PROJECT NAME: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1107

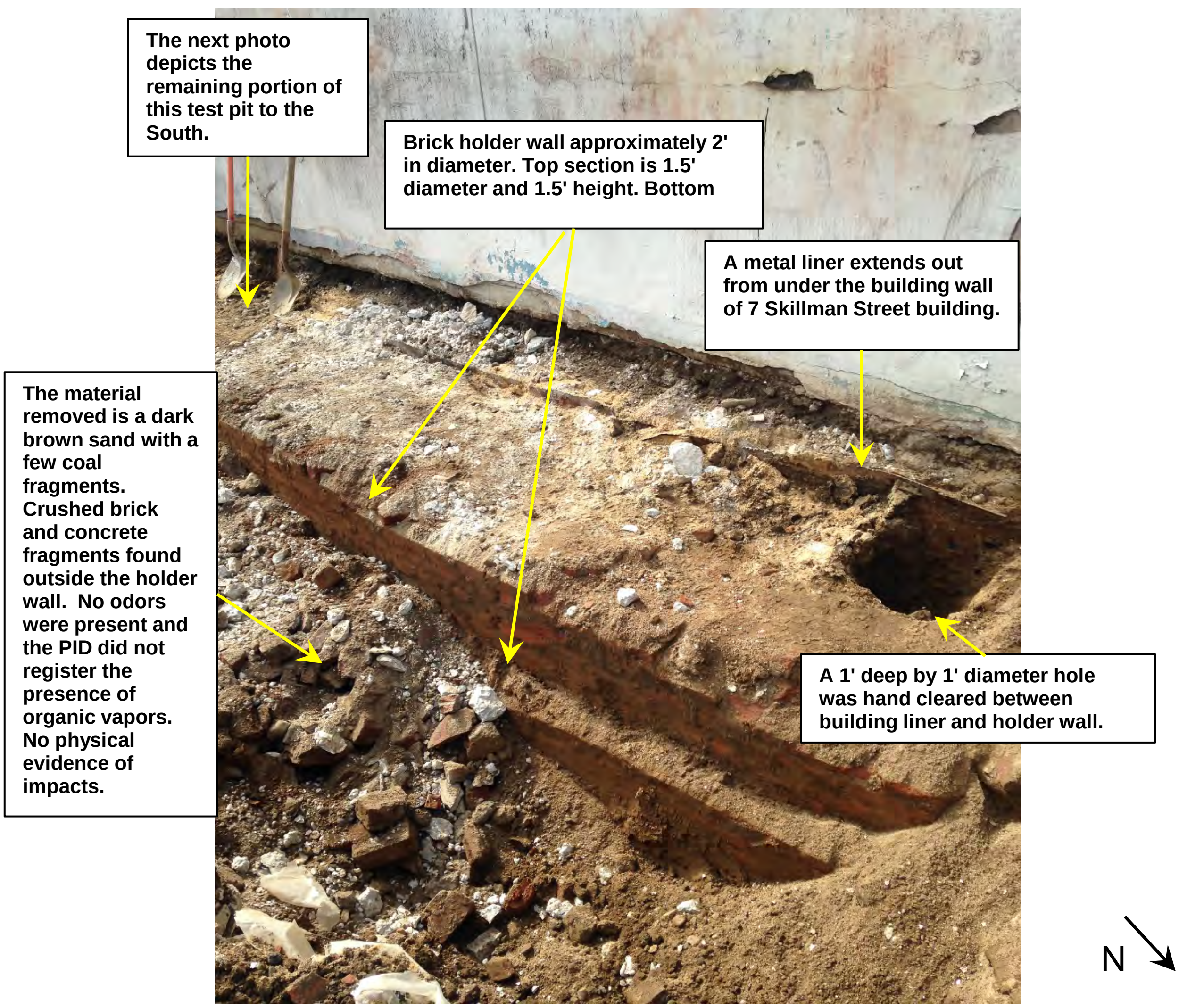
GEI Consultants

GEI Consultants	GEI Consultants, Inc., P.C. 455 Winding Brook Drive Glastonbury, CT 06033 (860) 368-5300	CLIENT:	National Grid	TEST PIT LOG	
		PROJECT:	Former Skillman Street Holder Station Site	PAGE 1 of 2	SSTP-01
		CITY/ST:	Brooklyn, New York		
		GEI PROJECT #:	093080-1-1107		

NORTHING: 679793.21 EASTING: 642565.83
NORTHING: 679770.98 EASTING: 642569.37
OBSERVED BY: Jonathan Tamargo
OPERATOR: Carlos Contreras (Island Pump and Tank)
EQUIPMENT: CAT 420 rubber-tired backhoe
WEATHER: 60s, clear, dry

LOCATION: Southeast side of northeastern Holder No. 1
TOTAL DEPTH: ~ 5 ft
TOTAL LENGTH: ~ 20 ft
TOTAL WIDTH: ~ 8 ft
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
DATE START / END: 03/08/2016 - 03/08/2016

Photograph 1: Facing Southwest

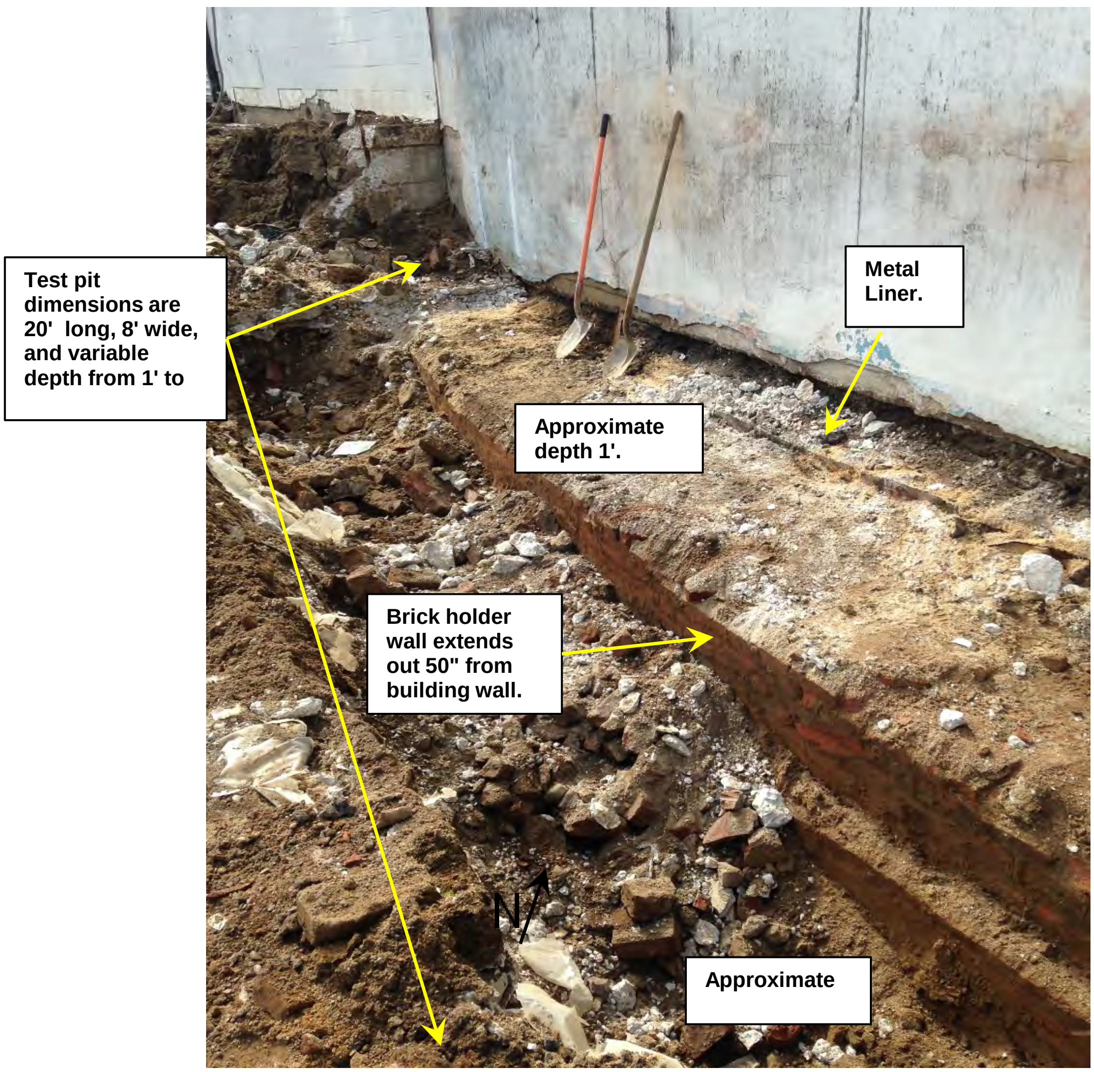


GEI Consultants	GEI Consultants, Inc., P.C. 455 Winding Brook Drive Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Former Skillman Street Holder Station Site CITY/ST: Brooklyn, New York GEI PROJECT #: 093080-1-1107	TEST PIT LOG PAGE 2 of 2	SSTP-01

NORTHING: 679793.21 EASTING: 642565.83
NORTHING: 679770.98 EASTING: 642569.37
OBSERVED BY: Jonathan Tamargo
OPERATOR: Carlos Contreras (Island Pump and Tank)
EQUIPMENT: CAT 420 rubber-tired backhoe
WEATHER: 60s, clear, dry

LOCATION: Southeast side of northeastern Holder No. 1
TOTAL DEPTH: ~ 5 ft
TOTAL LENGTH: ~ 20 ft
TOTAL WIDTH: ~ 8 ft
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
DATE START / END: 03/08/2016 - 03/08/2016

Photograph 2: Facing South



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ATTACHMENT 2

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-06 (11-16) 8/25/2010
BTEX (Õg/L)		
Toluene	5	**1100**
Ethylbenzene	5	**930**
Total Xylene	5	**3900**
Total BTEX	NE	**5930**
Other VOCs (Õg/L)		
Styrene	5	**1800**
Total VOCs	NE	**7730**
PAHs (Õg/L)		
Naphthalene	10*	**3300**
Total PAHs	NE	**3400**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**3400**
Total Metals (Õg/L)		
Iron	300	**6840**
Manganese	300	**5830**
Sodium	20000	**99900**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-06 (25-30) 5/31/2011
BTEX (Õg/L)		
Benzene	1	**410**
Toluene	5	**600**
Ethylbenzene	5	**720**
Total Xylene	5	**1700**
Total BTEX	NE	**3430**
Other VOCs (Õg/L)		
cis-1,2-Dichloroethene	5	**600**
Styrene	5	**92**
Vinyl chloride	2	**290**
Total VOCs	NE	**4412**
PAHs (Õg/L)		
Naphthalene	10*	**1200**
Total PAHs	NE	**1214**
Other SVOCs (Õg/L)		
2-Methylphenol (o-Cresol)	1	**21 J**
Total SVOCs	NE	**1235**
Total Metals (Õg/L)		
Manganese	300	**3460**
Sodium	20000	**109000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-08 (7-17) 9/9/2011
BTEX (ug/L)		
Total BTEX	NE	ND
Other VOCs (ug/L)		
Total VOCs	NE	17.4
PAHs (ug/L)		
Total PAHs	NE	ND
Other SVOCs (ug/L)		
Phenol	1	**1.4**
Total SVOCs	NE	1.4

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-02 (11-21) 5/31/2011
BTEX (Õg/L)		
Benzene	1	**100 J**
Toluene	5	**260**
Ethylbenzene	5	**250**
Total Xylene	5	**800**
Total BTEX	NE	**1410**
Other VOCs (Õg/L)		
Acetone	50*	**850**
cis-1,2-Dichloroethene	5	**8000**
trans-1,2-Dichloroethene	5	**39 J**
Styrene	5	**360**
Tetrachloroethene (PCE)	5	**9400**
Trichloroethene (TCE)	5	**1900**
Vinyl chloride	2	**380**
Total VOCs	NE	**22339**
PAHs (Õg/L)		
Naphthalene	10*	**490**
Total PAHs	NE	**500**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**500**
Total Metals (Õg/L)		
Iron	300	**26400**
Manganese	300	**7070**
Sodium	20000	**114000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-05 (8-18) 8/9/2010
BTEX (Õg/L)		
Total BTEX	NE	ND
Other VOCs (Õg/L)		
Total VOCs	NE	ND
PAHs (Õg/L)		
Total PAHs	NE	ND
Other SVOCs (Õg/L)		
Total SVOCs	NE	**1**
Total Metals (Õg/L)		
Iron	300	**10100**
Manganese	300	**2780**
Sodium	20000	**59800**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-07 (7-17) 9/9/2011
BTEX (ug/L)		
Total BTEX	NE	ND
Other VOCs (ug/L)		
Total VOCs	NE	2.12
PAHs (ug/L)		
Total PAHs	NE	ND
Other SVOCs (ug/L)		
Total SVOCs	NE	0.62

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-03 (12-22) 5/31/2011
BTEX (Õg/L)		
Total BTEX	NE	**4.36**
Other VOCs (Õg/L)		
Total VOCs	NE	**9.06**
PAHs (Õg/L)		
Total PAHs	NE	**5.6**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**6.22**
Total Metals (Õg/L)		
Iron	300	**3720**
Manganese	300	**965**
Sodium	20000	**197000**

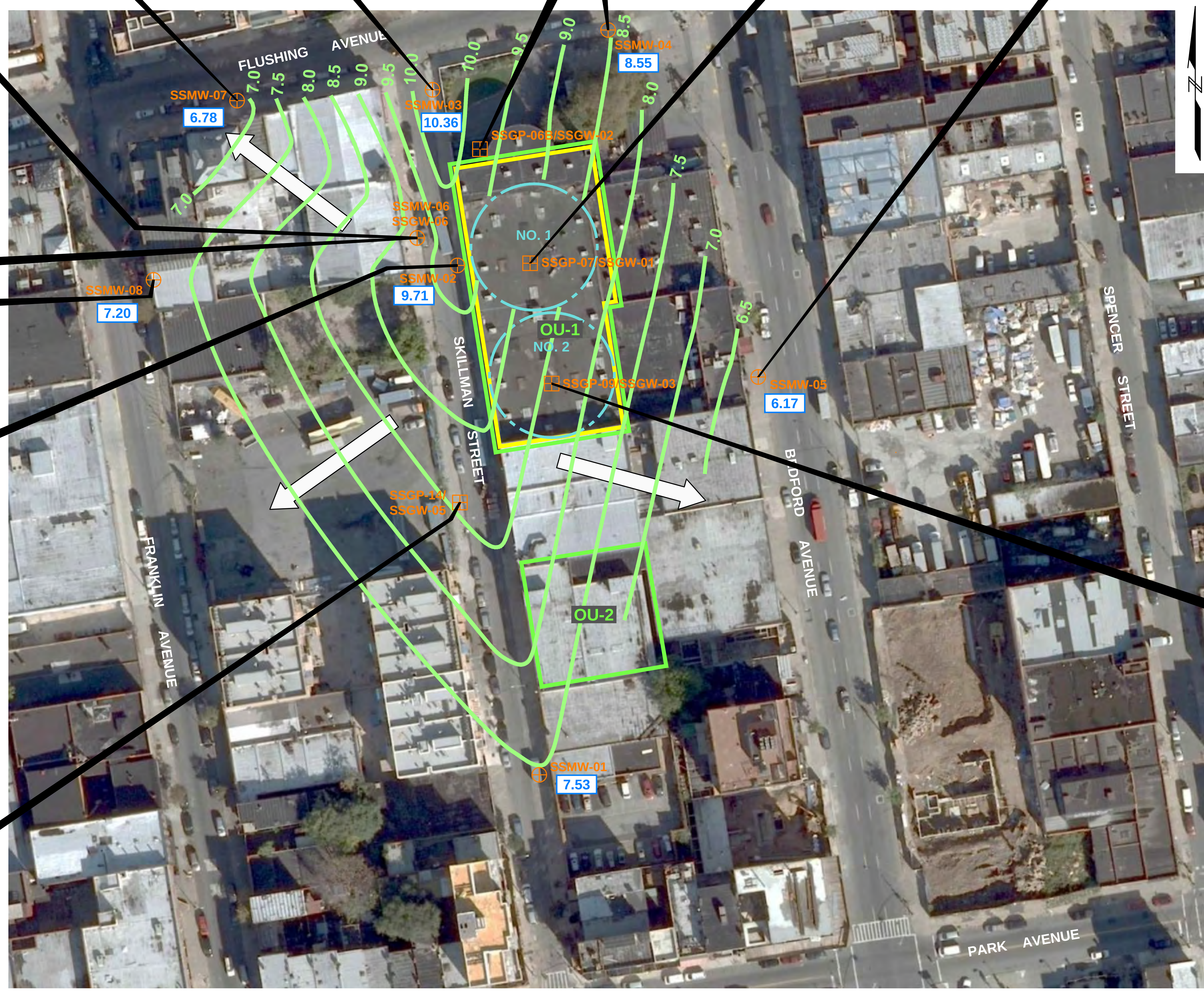
Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-02 (13-23) 6/28/2013
BTEX (Õg/L)		
Benzene	1	**240**
Toluene	5	**79**
Ethylbenzene	5	**32**
o-Xylene	5	**150**
m/p-Xylene	5	**100**
Total BTEX	NE	**601**
Other VOCs (Õg/L)		
cis-1,2-Dichloroethene	5	**1900**
Isopropyl benzene	5	**64**
Tetrachloroethene (PCE)	5	**230**
Trichloroethene (TCE)	5	**140**
Vinyl chloride	2	**200**
Total VOCs	NE	**3135**
PAHs (Õg/L)		
Naphthalene	10*	**62**
Total PAHs	NE	**62**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**62**
Total Metals (Õg/L)		
Chromium	50	**68**
Iron	300	**50000**
Lead	25	**75**
Manganese	300	**2700**
Sodium	20000	**83000**
Total Cyanide (Õg/L)		
Total Cyanide	200	**330 J**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-04 (10-20) 6/1/2011
BTEX (Õg/L)		
Total BTEX	NE	ND
Other VOCs (Õg/L)		
Tetrachloroethene (PCE)	5	**12**
Total VOCs	NE	**14.22**
PAHs (Õg/L)		
Total PAHs	NE	ND
Other SVOCs (Õg/L)		
Total SVOCs	NE	**0.85**
Total Metals (Õg/L)		
Antimony	3	**5.1 J**
Iron	300	**15100**
Magnesium	35000*	**188000**
Manganese	300	**1590**
Selenium	10	**20.3 J**
Sodium	20000	**87500**
Thallium	0.5*	**4 J**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-01 (11.5-21.5) 6/27/2013	Duplicate of: SSGW-01 (11.5-21.5) 6/27/2013
BTEX (Õg/L)			
Benzene	1	**4300**	**5600**
Toluene	5	**16000**	**20000**
Ethylbenzene	5	**9500**	**12000**
o-Xylene	5	**4000**	**4900**
m/p-Xylene	5	**7700**	**9400**
Total BTEX	NE	**41500**	**51900**
Other VOCs (Õg/L)			
Isopropyl benzene	5	**350**	**420**
Styrene	5	**70 J**	**82**
Total VOCs	NE	**41920**	**52402**
PAHs (Õg/L)			
Naphthalene	10*	**5600 J**	**3300 J**
Total PAHs	NE	**5600**	**3500**
Other SVOCs (Õg/L)			
Total SVOCs	NE	**5600**	**3500**
Total Metals (Õg/L)			
Iron	300	**20000**	**26000**
Lead	25	**83 J**	**280 J**
Manganese	300	**690 J**	**1300 J**
Sodium	20000	**100000**	**110000**
Total Cyanide (Õg/L)			
Total Cyanide	200	**240 J**	**200 J**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSMW-05 (11-21) 6/1/2011	Duplicate of SSMW-05 (11-21) 6/1/2011
BTEX (Õg/L)			
Total BTEX	NE	ND	ND
Other VOCs (Õg/L)			
1,2-Dichloroethane	0.6	**4.3 J**	**4.1 J**
Tetrachloroethene	5	**5.6**	5 U
Total VOCs	NE	**9.9**	**4.1**
PAHs (Õg/L)			
Total PAHs	NE	ND	ND
Other SVOCs (Õg/L)			
Total SVOCs	NE	**1.11**	**1.06**
Total Metals (Õg/L)			
Manganese	300	**7440**	**7540**
Sodium	20000	**293000**	**276000**

Sample Name: / Well Screen Depth (feet): / Sample Date:	NYS AWQS	SSGW-03 (15-25) 6/26/2013
BTEX (Õg/L)		
Benzene	1	**13**
Total BTEX	NE	**13**
Other VOCs (Õg/L)		
cis-1,2-Dichloroethene	5	**9.2**
Total VOCs	NE	**22.2**
PAHs (Õg/L)		
Total PAHs	NE	**ND**
Other SVOCs (Õg/L)		
Total SVOCs	NE	**ND**
Total Metals (Õg/L)		
Chromium	50	**380**
Copper	200	**390**
Iron	300	**410000**
Lead	25	**170**
Magnesium	35000*	**150000**
Manganese	300	**30000**
Nickel	100	**280**
Sodium	20000	**140000**



LOCATION OF DEWATERING WELLS

0 600 1200

SCALE, FEET

NOTE:

SSMW-01 IS LOCATED IN OU-2 AND IS INCLUDED IN THIS FIGURE BECAUSE IT WAS GAUGED TO DEVELOP GROUNDWATER CONTOURS FOR THE SITE.

LEGEND:

SITE BOUNDARY(APPROXIMATE)
OU-1 BOUNDARY(APPROXIMATE)
HISTORICAL GAS HOLDER

SAMPLE LOCATIONS:

SSMW-02	MONITORING WELL
SSGW-05	TEMPORARY GROUNDWATER SAMPLING POINT
7.5	GROUNDWATER CONTOUR (FEET NAVD)
8.04	GROUNDWATER ELEVATION (FEET NAVD)
	INFERRED GROUNDWATER FLOW DIRECTION
NAVD	NORTH AMERICAN VERTICAL DATUM

NYS AWQS - New York State Ambient Water Quality Standards and Guidance Values for GA groundwater

NE	not established
ND	not detected
J	estimated value
U	indicates not detected to the reporting limit for organic analysis and the method detection limit for inorganic analysis
*	indicates the value is a guidance value and not a standard
BOLD	indicates detected concentration
BOLD	indicates that the detected concentration is above the NYS AWQS objective it was compared to
Õg/L	micrograms per liter or parts per billion (ppb)
BTEX	benzene, toluene, ethylbenzene, and xylene
PAHs	polycyclic aromatic hydrocarbons
VOCs	volatile organic compounds
SVOCs	semi-volatile organic compounds

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11 AND 6/23/11. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.

0 80 160

SCALE, FEET

OU-1 SITE CHARACTERIZATION REPORT
SKILLMAN STREET HOLDER STATION
BROOKLYN, NEW YORK

nationalgrid

Project 093080-1-1102

GEI Consultants
455 WINDING BROOK DRIVE
SUITE 201
GLASTONBURY, CONNECTICUT 06033

GROUNDWATER CONTOURS (SEPTEMBER 9, 2011) AND GROUNDWATER ANALYTICAL SUMMARY (Õg/L)

March 2014

Figure 6

I:\Project\National Grid\Skillman Street\093080\Site Characterization\Report\Skillman St-SCR Figures 2-2014.dwg

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-03A (0.5-3.5) 8/12/2010	SSGP-03A (15-17) 8/12/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	**1.004**	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**1.004**	ND

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-06 (3-3.5) 6/27/2013	SSGP-06 (15-17) 6/27/2013	SSGP-06 (31-32) 6/27/2013
BTEX (mg/kg)					
Total BTEX	NE	NE	ND	ND	ND
Other VOCs (mg/kg)					
Total VOCs	NE	NE	**0.0313**	**0.0586**	ND
PAHs (mg/kg)					
Benzo(b)fluoranthene	1	5.6	**1.1**	0.039 U	0.036 U
Total PAHs	NE	500	**10.587**	ND	ND
Other SVOCs (mg/kg)					
Total SVOCs	NE	NE	**10.587**	ND	ND
Metals (mg/kg)					
Copper	50	270	**63**	**22**	**25**
Lead	63	1000	**160 J**	**4.6 J**	**7.1 J**
Mercury	0.18	2.8	**0.38**	0.02 U	0.018 U
Nickel	30	310	**31**	8.7 U	**11**
Zinc	109	10000	**280**	**23**	**31**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-17 (10-12) 8/22/2011
BTEX (mg/kg)			
Total BTEX	NE	NE	ND
Other VOCs (mg/kg)			
Total VOCs	NE	NE	ND
PAHs (mg/kg)			
Total PAHs	NE	NE	**0.181**
Other SVOCs (mg/kg)			
Total SVOCs	NE	NE	**0.181**

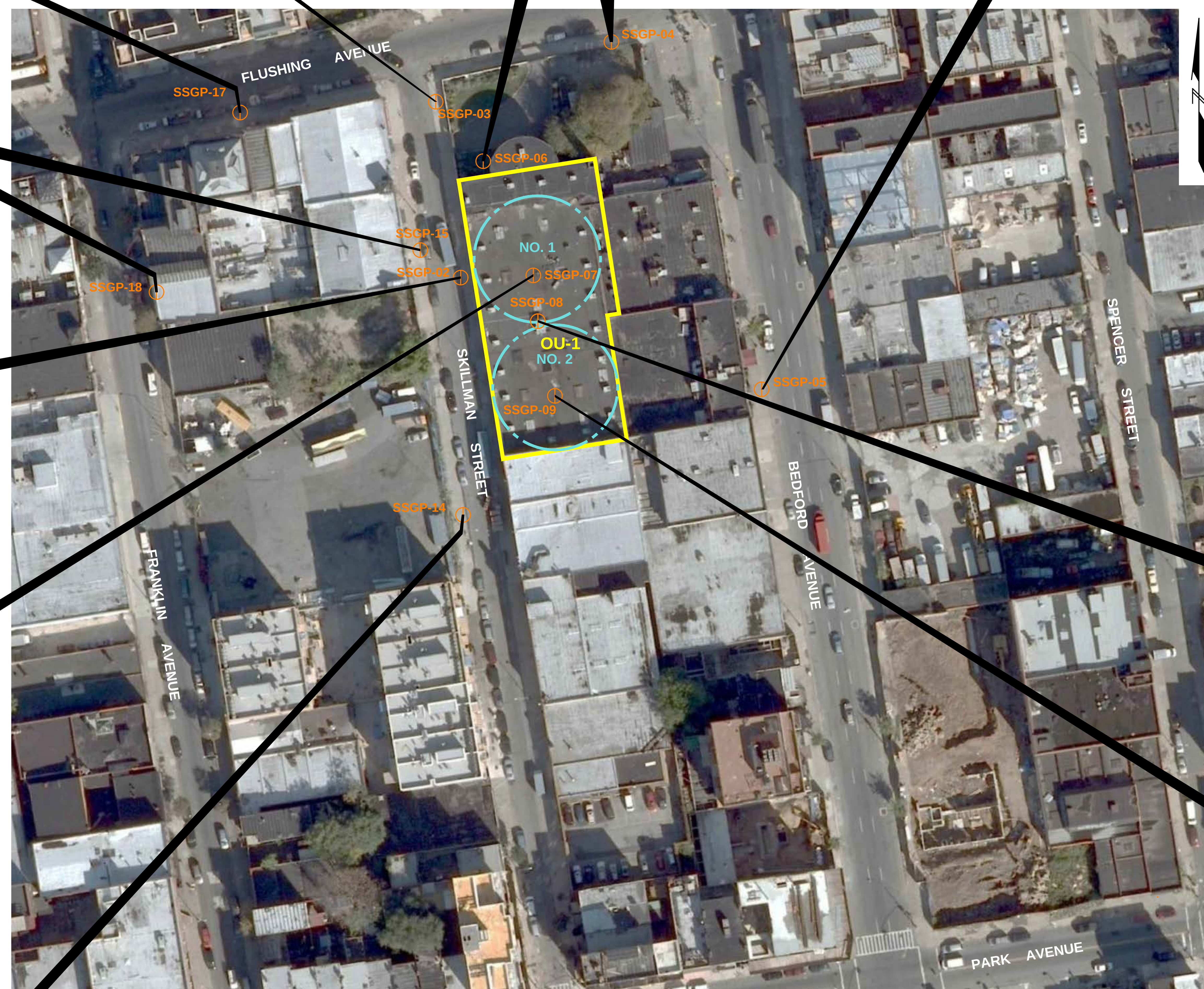
Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-04 (0.5-5) 8/20/2010	SSGP-04 (9.5-10.5) 8/20/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	**0.665**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**0.021**	**0.665**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-05 (0.5-5) 8/16/2010	SSGP-05 (15) 8/16/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**0.12**	**0.061**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-15 (2-5) 8/19/2010	SSGP-15 (13.5-15) 8/19/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	**0.01517**
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	**0.02617**
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	**1.786**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	ND	**1.786**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-18 (10-12) 8/23/2011
BTEX (mg/kg)			
Total BTEX	NE	NE	ND
Other VOCs (mg/kg)			
Total VOCs	NE	NE	ND
PAHs (mg/kg)			
Total PAHs	NE	NE	**0.744**
Other SVOCs (mg/kg)			
Total SVOCs	NE	NE	**0.744**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-02 (0.5-5) 8/9/2010	SSGP-02 (26.7-28.3) 8/9/2010
BTEX (mg/kg)				
Toluene	0.7	500	0.0057 U	**160**
Ethylbenzene	1	390	0.0057 U	**220**
Total Xylene	0.26	500	0.0057 U	**840**
Total BTEX	NE	NE	**0.001**	**1220**
Other VOCs (mg/kg)				
Acetone	0.05	500	**0.091 J**	58 UJ
Total VOCs	NE	NE	**0.092**	**1620**
PAHs (mg/kg)				
Naphthalene	12	500	**0.21 J**	**1000**
Total PAHs	NE	NE	**2.067**	**1218.7**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**2.113**	**1218.7**



Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-07 (3-4) 6/26/2013	Duplicate of: SSGP-07 (3-4) 6/26/2013	SSGP-07 (10-15) 6/26/2013	SSGP-07 (20-22) 6/26/2013
BTEX (mg/kg)						
Benzene	0.06	44	**0.0013 J**	**0.0011 J**	0.0013 UJ	**0.61 J**
Toluene	0.7	500	0.0024 UJ	0.0011 UJ	0.0013 UJ	**12 J**
Ethylbenzene	1	390	0.0024 UJ	0.0011 UJ	0.0013 UJ	**29 J**
o-Xylene	0.26	500	0.0024 UJ	0.0011 UJ	0.0013 UJ	**11 J**
m/p Xylene	0.26	500	0.0024 UJ	0.0011 UJ	0.0013 UJ	**25 J**
Total BTEX	NE	NE	**0.0013**	**0.0011**	0.0013 UJ	**77.61**
Other VOCs (mg/kg)						
Total VOCs	NE	NE	**0.0358**	**0.0291**	ND	**80.85**
PAHs (mg/kg)						
Benzo(b)fluoranthene	1	5.6	**0.85**	**1.3**	0.043 U	0.22 U
Benzo(a)anthracene	1	5.6	**1.1**	**1.5**	**0.055**	0.22 U
Benzo(a)pyrene	1	1	**0.86**	**1.4**	0.043 U	0.22 U
Chrysene	1	56	**0.96**	**1.5**	0.43 U	2.2 U
Indeno(1,2,3-cd)pyrene	0.5	5.6	**0.61 J**	**1.2 J**	0.043 U	0.22 U
Naphthalene	12	500	0.37 U	0.37 U	0.43 U	**38 J**
Total PAHs	NE	500	**10.638**	**16.58**	0.055	**46.1**
Other SVOCs (mg/kg)						
Total SVOCs	NE	NE	**10.638**	**16.58**	**0.055**	**46.1**
Metals (mg/kg)						
Lead	63	1000	**270 J**	**330 J**	**56 J**	**160 J**
Mercury	0.18	2.8	**0.31**	**0.28**	**0.033**	**0.07**
Nickel	30	310	**21**	**20**	**69**	**41**
Zinc	109	10000	**230**	**170**	**49**	**80**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-08 (3.5-4.5) 6/25/2013	SSGP-08 (10-10.5) 6/25/2013
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	500	**0.338**	ND
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	**0.338**	**ND**
Metals (mg/kg)				
Copper	50	270	**63**	**25**
Lead	63	1000	**330 J**	**73 J**
Nickel	30	310	**170**	**36**

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-09 (3.0-3.4) 6/25/2013	SSGP-09 (16.4-17.4) 6/25/2013	SSGP-09B (26-26.5) 6/26/2013
BTEX (mg/kg)					
Total BTEX	NE	NE	ND	ND	ND
Other VOCs (mg/kg)					
Total VOCs	NE	NE	ND	ND	ND
PAHs (mg/kg)					
Total PAHs	NE	500	ND	ND	ND
Other SVOCs (mg/kg)					
Total SVOCs	NE	NE	ND	ND	ND

Sample Name: / Sample Depth (feet): / Sample Date:	UNRESTRICTED USE SCO	RESTRICTED USE SCO - COMMERCIAL	SSGP-14 (3-5) 8/9/2010	SSGP-14 (12.75-13) 8/9/2010
BTEX (mg/kg)				
Total BTEX	NE	NE	ND	ND
Other VOCs (mg/kg)				
Total VOCs	NE	NE	ND	ND
PAHs (mg/kg)				
Total PAHs	NE	NE	ND	**1.182**
Other SVOCs (mg/kg)				
Total SVOCs	NE	NE	ND	**1.182**

LEGEND:

OU-1 BOUNDARY(APPROXIMATE)

HISTORICAL GAS HOLDER

SAMPLE LOCATIONS:

SSGP-06 GEOPROBE® BORING

6 NYCRR -New York State Register and Official Compilation of Codes, Rules and Regulations of the State of New York

6 NYCRR 375 SCO UNRESTRICTED USE - regulatory comparison against NYCRR, Chapter IV, Part 375-6 Unrestricted Use Soil Cleanup Objectives

6 NYCRR 375 SCO RESTRICTED USE RESTRICTED-RESIDENTIAL - regulatory comparison against NYCRR, Chapter IV, Part 375-6 Restricted Use Restricted-Residential Soil Cleanup Objectives

mg/kg	milligrams/kilogram or parts per million (ppm)
ft bgs	feet below ground surface
BTEX	benzene, toluene, ethlybenzene, and xylene
PAHs	polycyclic aromatic hydrocarbons
VOCs	volatile organic compounds
SVOCs	semi-volatile organic compounds
NE	not established
ND	not detected; total concentration is listed as ND because no compounds were detected in the group
U	indicates not detected at or above the reporting limit shown
J	estimated value
BOLD	indicates a detected concentration
BOLD	indicates that the detected result value exceeds established 6 NYCRR SCO UNRESTRICTED USE
BOLD	indicates that the detected result value exceeds established 6 NYCRR SCO RESTRICTED USE COMMERCIAL

SOURCES:

1. BING AERIAL IMAGERY © 2011 MICROSOFT CORPORATION (www.bing.com/maps) ACCESSED ON 06/24/11.
2. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. ON 5/31/11 AND 6/23/11. SURVEY BY NEW YORK STATE LICENSED LAND SURVEYOR NUMBER 050146. HORIZONTAL DATUM: NEW YORK STATE PLANE COORDINATE SYSTEM (NY EAST ZONE), VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM (NAVD)88.

0 80 160

SCALE, FEET

OU-1 SITE CHARACTERIZATION REPORT
SKILLMAN STREET HOLDER STATION
BROOKLYN, NEW YORK

nationalgrid

Project 093080-1-1102

GEI Consultants
455 WINDING BROOK DRIVE
SUITE 201
GLASTONBURY, CONNECTICUT 06033

SUBSURFACE SOIL ANALYTICAL SUMMARY (mg/kg)

March 2014

Figure 7

I:\Project\National Grid\Skillman Street\093080\Site Characterization\Report\Skillman St-SCR Figures 2-2014.dwg

Donald P. Campbell
Lead Engineer
Site Investigation and Remediation

nationalgrid

April 29, 2016

Mr. Mendal Roth
Bedford Roth Holding LLC
760 Bedford Avenue
Brooklyn, NY 11205

Re: Skillman Street Holder Station Site
Brooklyn, Kings County, New York
Site No. 224068
Geotechnical Soil Samples Collected in March 2016

Dear Mr. Roth:

I'm writing to transmit geotechnical data that was inadvertently excluded from my letter of April 22, 2016. Please find the geotechnical data attached.

Sincerely,

Donald P. Campbell

Donald P. Campbell
Project Manager

ec:	R. Deyette	NYSDEC
	G. Heitzman	NYSDEC
	S. Malsan	NYSDEC
	D. Tuohy	NYSDEC
	B. Boyd	NYSDOH
	T. Leissing	National Grid
	F. Murphy	National Grid
	L. Schnapf	Schnapf
	J. Brooks	Philips Nizer
	A. Ahles	GEI
	M. Felter	GEI
	M. O'Neil	GEI

287 Maspeth Avenue, Brooklyn, NY 11211
T: 718.963.5453 F: 718.963.7890 donald.campbell@nationalgrid.com www.nationalgrid.com

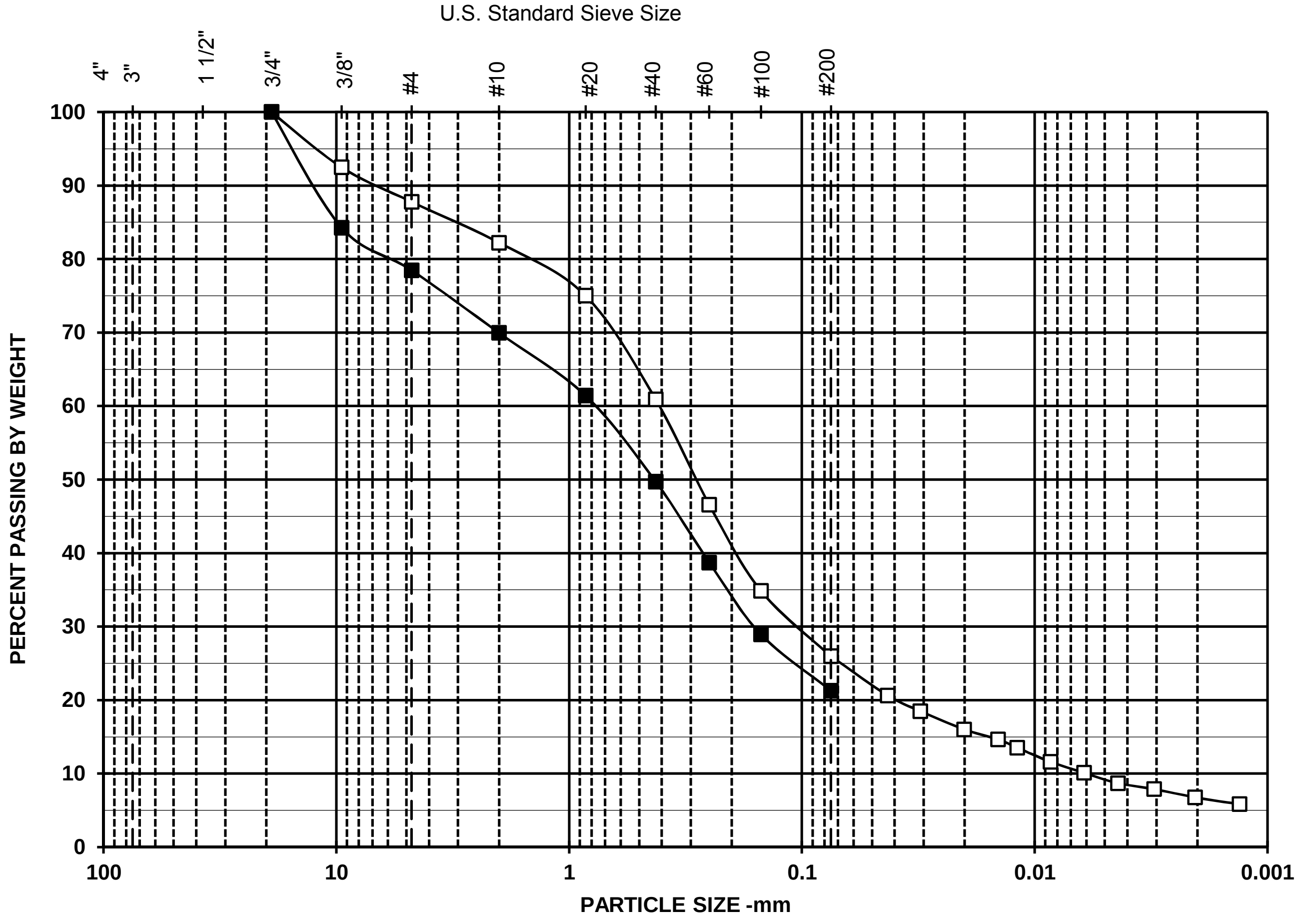
ATTACHMENT

GEI Consultants #46012036
Former Skillman Street Holder Station Site PDI
LABORATORY TESTING DATA SUMMARY

BORING NO.	SAMPLE NO.	DEPTH (ft)	IDENTIFICATION TESTS				REMARKS
			WATER CONTENT (%)	USCS SYMB. (1)	SIEVE MINUS NO. 200 (%)	HYDRO. % MINUS 2 μm (%)	
SSSB-19		10-15	17.8	SM	26.0	7	
SSSB-22	1	27	11.3	SM	21.3		

Note: (1) USCS symbol based on visual observation and Sieve reported.

COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	



SYMBOL	w (%)	LL	PL	PI	USCS	DESCRIPTION AND REMARKS	Date Tested
□	17.8				SM	Brown, Silty sand	3/18/2016
■	11.3				SM	Brown, Silty sand with gravel	3/18/2016
○							

Symbol	□	■	○
Boring	SSSB-19	SSSB-22	
Sample		1	
Depth	10-15	27	
% +3"	0.0	0.0	
% Gravel	12.2	21.5	
% SAND	61.8	57.2	
%C SAND	5.5	8.5	
%M SAND	21.3	20.2	
%F SAND	35.0	28.5	
% FINES	26.0	21.3	
% -2μ	7		
D_{100} (mm)	19.00	19.00	
D_{60} (mm)	0.41	0.80	
D_{30} (mm)	0.11	0.16	
D_{10} (mm)			
Cc			
Cu			

Particle Size (Sieve #)	PERCENT FINER □	■	○
4"			
3"			
1 1/2"			
3/4"	100.0	100.0	
3/8"	92.5	84.3	
4	87.8	78.5	
10	82.2	69.9	
20	75.0	61.4	
40	60.9	49.7	
60	46.6	38.7	
100	34.9	28.9	
200	26.0	21.3	

TerraSense, LLC | **GEI Consultants**

7960-16005

PARTICLE SIZE DISTRIBUTION

Former Skillman Street Holder Station Site PDI

nationalgrid

Donald Campbell
Project Manager

July 17, 2011

HAND DELIVERED

Emanual Roth
Bedford Flushing Holding Corporation
760 Bedford Avenue
Brooklyn, New York 11205

RE: Sub-Slab Soil Vapor and Air Testing Results
7 Skillman Street
Brooklyn, New York 11205
Former Skillman Street Holder Station
Index No. A2-055-0606/Site No. 224068

Dear Mr. Roth:

I am writing to provide you with the results for the sub-slab soil vapor and air testing at 7 Skillman Street in Brooklyn, New York (the "Property"). The Property is the former location of two gas holders that were part of the former Brooklyn Union Gas Company Skillman Street Holder Station. National Grid is currently conducting a Site Characterization ("SC") of the Skillman Street Holder Station under the oversight of New York State Department of Environmental Conservation ("NYSDEC") and New York State Department of Health ("NYSDOH"). Gas stored in the holders was produced at former manufactured gas plants ("MGPs") that were located nearby. Enclosed are the sub-slab soil vapor and air testing results and a figure that shows the sample locations.

The samples were collected on March 24 and 25, 2011 as part of the SC activities National Grid is completing under the NYSDEC / NYSDOH approved "*Site Characterization Work Plan Alternate Approach for 7 Skillman Street*." The alternate approach was designed to determine if there is a vapor intrusion pathway at the building. Figure 1 shows the sample locations.

At the time of the SC activities, the Property was used for commercial purposes including catering, weddings and other events. The Property and surrounding area are zoned for mixed uses.

<u>Summary of Sampling Activities</u>

On behalf of National Grid, GEI Consultants, Inc. ("GEI") and GEI's drilling subcontractor (Zebra Environmental, Inc.) conducted SC activities at the Property on March 22, 24, and 25, 2011. The investigation activities included installing two sub-slab soil vapor points (SSSV-01 and SSSV-02) and collecting sub-slab soil vapor samples, collecting two indoor air samples (SSIA-01 and SSIA-02), and collecting an outdoor air sample (SSOA-01).

Sub-slab soil vapor and air samples were shipped to TestAmerica in Knoxville, Tennessee, a NYSDOH-approved laboratory, for chemical analysis. Each sample was analyzed for volatile organic compounds ("VOCs") and naphthalene by EPA Method TO-15. Although naphthalene is a semivolatile organic compound (SVOC), it is possibly MGP-related and therefore analyzed during this

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investigation. Sub-slab soil vapor samples were also analyzed for helium by ASTM Method 1946, since helium is used as a soil vapor tracer gas. In accordance with NYSDOH guidance, each sub-slab soil vapor sample was collected beneath an enclosure enriched with helium gas to evaluate potential infiltration of ambient air.

The two sub-slab soil vapor sample points were installed using a concrete coring machine. A duplicate sub-slab soil vapor sample was also collected at SSSV-01. Two ambient indoor air samples (SSIA-01 and SSIA-02) and an ambient outdoor air sample (SSOA-01) were collected concurrently with the sub-slab soil vapor samples. A duplicate indoor air sample was also collected at SSIA-01. Each sub-slab soil vapor and the ambient air sample were collected through calibrated flow controllers into certified Summa® canisters provided by TestAmerica.

Summary of Findings

Validated laboratory testing results for constituents detected in the samples are provided in Table 1.

Indoor and outdoor air analytical results were compared to concentrations of VOCs collected by the Environmental Protection Agency ("EPA") as part of the Building Assessment and Survey Evaluation ("BASE") study in 2001. The EPA BASE study was conducted to assess VOCs within indoor air in public and commercial office buildings. This study is used to provide context and guidance when assessing indoor air sample results. The indoor air analytical results were screened against the 90th percentile (i.e. at or below 90 percent of detected values) of the EPA BASE indoor air values. The outdoor air analytical data was screened against the 90th percentile of the EPA BASE outdoor air values. Values that are detected are bold and values above the screening criteria are highlighted in gray in Table 1. Qualifiers are shown in Table 1 for non-detect results (i.e., those results having a "U" qualifier) and for estimated values (i.e., those results having a "J" qualifier). Concentrations of compounds detected in air above the 90th percentile of the EPA BASE levels are shaded in gray in Table 1.

New York State currently does not have standards, criteria or guidance values for concentrations of VOCs or naphthalene in soil vapor and there is no database of "background" levels in soil vapor.

In addition to the EPA BASE study, Table 1 includes indoor air guidelines established by New York State for three (3) VOCs: trichloroethene (TCE), tetrachloroethene (PCE), and methylene chloride. The guidelines are established to provide context for the concentrations and reduce exposures to the chemicals. NYSDOH has also developed matrices that indicate what, if any, action is recommended based on the concentrations of PCE, TCE, 1,1,1-TCA, and carbon tetrachloride detected in indoor air and sub-slab vapor.

Soil vapor samples were collected from sub-slab soil vapor points SSSV-01 and SSSV-02. Two indoor air samples (SSIA-01 and SSIA-02) and one outdoor air sample (SSOA-01) were collected to evaluate ambient air concentrations during the soil vapor sample collection. Several VOC compounds were detected in sub-slab soil vapor, indoor air, and outdoor air. The soil vapor tracer gas, helium, was not detected within soil vapor sample SSSV-01 and at 0.83% within soil vapor sample SSSV-02. This indicates that leaking of ambient air into sub-slab soil vapor sample points was negligible, thus indicating that the soil vapor samples were representative of subsurface conditions.

Sub-Slab Soil Vapor Results

Sub-slab soil vapor samples contained compounds that are common to MGP operations and petroleum products, including benzene, toluene, ethylbenzene and xylene compounds [BTEX], 1,2,4-trimethlybenzene, indane, nonane, n-decane, n-undecane, n-dodecane, and/or naphthalene. Concentrations of ethanol, carbon disulfide, and a number of chlorinated solvents including TCE, PCE, 1,1,1-trichloroethane (1,1,1-TCA), carbon tetrachloride, and cis-1,2 dichloroethene were also detected in the sub-slab soil vapor samples. Chlorinated solvents, ethanol, and carbon disulfide are not associated with MGP operations.

Indoor Air Results

Only one compound, ethanol, was detected at concentrations above the EPA BASE study background levels. The concentrations of ethanol exceed the concentrations found within sub-slab vapor, indicating sub-slab soil vapor is not the source for ethanol in indoor air. Ethanol is found in hand sanitizers and styling gel which were observed at the Property. National Grid was not allowed access to the kitchen during sampling. If alcoholic beverages are stored in the kitchen or elsewhere at the Property, they are also a potential source of ethanol.

VOCs were not detected above the NYSDOH Air Guidance Values. TCE was not detected in indoor air. PCE concentrations in indoor air were below the NYSDOH Air Guidance Value of 100 µg/m3 and ranged from 0.29 to 0.66 µg/m3. Methylene chloride concentrations in indoor air were below the NYSDOH Air Guidance Value of 60 µg/m3 and ranged from not detected to 5.9 µg/m3.

Chlorinated solvents such as PCE, TCE, and methylene chloride and ethanol and carbon disulfide are not associated with MGP operations. No possibly MGP-related compounds were detected in indoor air samples at concentrations exceeding the EPA BASE study background levels.

Ambient Air Results

SSOA-01 did not contain concentrations of VOCs above the NYSDOH Background Air concentrations. The relatively low concentrations of compounds detected in the ambient air indicate that concentrations of analytes detected in indoor air are not attributable to ambient, background conditions.

Conclusions/Recommendations

Based on the analytical results of samples collected for this evaluation, the sub-slab soil vapor contains the chlorinated solvents TCE and PCE at concentrations higher than guidance concentrations suggested by EPA and NYSDOH. These compounds are not MGP-related.

NYSDOH has developed matrices that indicate what, if any, action is recommended based on the concentrations of PCE, TCE, 1,1,1-TCA, and carbon tetrachloride detected in indoor air and / or sub-slab vapor. The matrices from the NYSDOH Vapor Intrusion Guidance document are attached. TCE and carbon tetrachloride are evaluated on Matrix 1. PCE and 1,1,1-TCA are evaluated on Matrix 2. **Please note that the NYSDOH Guidance includes what, if any, action NYSDOH recommends when PCE, TCE, 1,1,1-TCA, and carbon tetrachloride are detected. In this instance, the Guidance recommends that mitigation be undertaken to minimize the potential for human exposure associated with the migration of PCE and TCE into the indoor air. The Guidance also recommends that the sources of carbon tetrachloride are identified and the exposures reduced.**

These findings will be detailed and incorporated into a comprehensive SC report once all the work proposed in the 2007 Site Characterization Work Plan and subsequent addendums has been completed. Should you have any questions regarding these results or the potential for any health effects, please contact Bridget Callaghan at the NYSDOH at (518) 402-7860. Should you have any questions pertaining to the environmental investigation of the Skillman Street Former Holder Station, please contact Mr. Scott Deyette of the DEC at (518) 402-9794 or contact me at (718) 963-5453. We thank you for your cooperation.

Sincerely,

Donald Campbell
Project Manager

cc: T. Bell – National Grid
A. Dubison – National Grid
J. Giordano – National Grid
R. Cawley – National Grid
S. Deyette – NYSDEC
B. Callaghan – NYSDOH

Encls.

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TABLE

Table 1
Analytical Sub-Slab Soil Vapor and Ambient Air Results
Former Skillman Street Holder Station Site
Brooklyn, New York

	Soil Vapor			EPA BASE Indoor Air Concentrations 90th Percentile[1]	NYSDOH Air Guidance Value	Indoor Air			EPA BASE Outdoor Air Concentrations 90th Percentile[1]	Outdoor Air
Sample Name:	SSSV-01	Duplicate of SSSV-01	SSSV-02			SSIA-01	Duplicate of SSIA-01	SSIA-02		SSOA-01
Sample Date:	3/25/2011	3/25/2011	3/24/2011			3/25/2011	3/25/2011	3/25/2011		3/25/2011
Possibly MGP-Related VOCs (ug/m3)										
Benzene	**9.4**	**12**	**35**	9.4	NE	**1.3**	**1.4**	**0.71**	6.6	**0.72**
Toluene	**60**	**59**	**96**	43	NE	**6.3 J**	**2.5 J**	**1.5**	33.7	**1.1**
Ethylbenzene	**5.5 J**	**7.8 J**	**12 J**	5.7	NE	**1.2 J**	**0.7 J**	**0.5**	3.5	**0.27 J**
m,p-Xylene	**17 J**	**24 J**	**40**	NE	NE	**3.3 J**	**2.3 J**	**1.7**	NE	**0.78**
o-Xylene	**5.2 J**	**7.4 J**	**13 J**	7.9	NE	**1.3 J**	**0.91 J**	**0.64**	4.6	**0.35**
Naphthalene	**2.4 J**	**2.6 J**	48 UJ	5.1	NE	**1.2 J**	1 UJ	1 UJ	4.9	1 UJ
Indane	**2.2 J**	**2.3 J**	18 UJ	NE	NE	0.39 UJ	0.39 UJ	0.39 UJ	NE	0.39 UJ
Bolding indicates a detected result concentration	3.8 UJ	0.76 UJ	35 UJ	NE	NE	0.76 UJ	0.76 UJ	0.76 U	NE	0.76 UJ
1,2,4-Trimethylbenzene	**7.8**	**10**	**12 J**	9.5	NE	**1.5 J**	**0.71 J**	**1.2**	5.8	**0.39 J**
Nonane	**4.8 J**	**5.7**	**8.4 J**	7.8	NE	**3.6 J**	**1.7 J**	**1.8**	2.8	**0.31 J**
n-Decane	**6.2 J**	**7.9**	**16 J**	17.5	NE	**6.5 J**	**1.2 J**	**1.8 J**	7.6	**1.4 J**
n-Undecane	**8.8 J**	**10 J**	120 UJ	22.6	NE	**2.4 J**	**0.46 J**	**0.49 J**	14.8	**0.4 J**
n-Dodecane	**1.9 J**	**2 J**	130 UJ	15.9	NE	**1.2 J**	2.8 UJ	2.8 UJ	10.4	2.8 UJ
Not MGP-Related VOCs (ug/m3)										
Acetaldehyde	36 UJ	**15 J**	330 UJ	NE	NE	**14 J**	**17 J**	**12 J**	NE	**7.2 J**
Acetone	**66 J**	**70 J**	220 U	98.9	NE	**20 J**	**18 J**	**13 J**	43.7	**8.3 J**
Acrolein (propenal)	3.7 U	**0.79**	33 U	NE	NE	**1.1 J**	**1.5 J**	**0.95**	NE	**0.69 J**
Allyl chloride(Chloropropene,3-)	1.3 U	0.25 U	11 U	NE	NE	0.25 U	0.25 U	0.25 U	NE	0.25 U
1-Benzothiophene	5.2 UJ	1 UJ	47 UJ	NE	NE	1 UJ	1 UJ	1 UJ	NE	1 UJ
Bromodichloromethane	2.7 U	0.54 U	24 U	NE	NE	0.54 U	0.54 U	0.54 U	NE	0.54 U
Bromoform	4.1 U	0.83 U	38 U	NE	NE	0.83 U	0.83 U	0.83 U	NE	0.83 U
Bromomethane	1.6 U	**0.27 J**	14 U	1.7	NE	0.31 U	0.31 U	0.31 U	1.6	0.31 U
1,3-Butadiene	**0.4 J**	**0.34 J**	16 U	3	NE	0.35 U	0.35 U	0.35 U	3.4	**0.088 J**
Butane	**1.7 J**	**1.3**	17 U	NE	NE	**17**	**16**	**4.9**	NE	**2.3**
2-Butanone	**8**	**10**	54 U	12	NE	**2.7**	**2**	**1.7**	11.3	**1.1 J**
t-Butyl alcohol(Tertiary Butyl Alcohol)	12 U	**1.1 J**	110 U	NE	NE	**0.9 J**	2.4 U	2.4 U	NE	2.4 U
Carbon disulfide	**11**	**9.1**	**15 J**	4.2	NE	0.62 U	0.62 U	0.62 U	3.7	0.62 U
Carbon tetrachloride	2.5 U	**0.35 J**	23 U	1.3	NE	**0.61**	**0.72**	**0.57**	0.7	**0.69**
Chlorobenzene	1.8 U	0.37 U	17 U	0.9	NE	0.37 U	0.37 U	0.37 U	0.8	0.37 U
Chloroethane	1.1 U	0.21 U	9.6 U	1.1	NE	0.21 U	0.21 U	0.21 U	1.2	0.21 U
Chloroform	**0.39 J**	**0.34 J**	**96**	1.1	NE	**0.21 J**	**0.22 J**	**0.17 J**	0.6	**0.14 J**
Chloromethane	2.1 U	**0.14 J**	19 U	3.7	NE	**1.5**	**1.5**	**1.4**	3.7	**1.4**
2-Chlorotoluene	4.1 U	0.83 U	38 U	NE	NE	**0.3 J**	**0.46 J**	**0.23 J**	NE	0.83 U
Cryofluorane(Freon-114)	2.8 U	0.56 U	25 U	NE	NE	0.56 U	**0.12 J**	**0.2 J**	NE	0.56 U
Cyclohexane	3.4 U	0.69 U	31 U	NE	NE	**1.5**	**1.1**	**0.4 J**	NE	0.69 U
Dibromochloromethane	3.4 U	0.68 U	31 U	NE	NE	0.68 U	0.68 U	0.68 U	NE	0.68 U
1,2-Dibromoethane	3.1 U	0.61 U	28 U	1.5	NE	0.61 U	0.61 U	0.61 U	1.6	0.61 U
1,2-Dichlorobenzene	2.4 U	**0.2 J**	22 U	1.2	NE	0.48 U	**0.26 J**	0.48 U	1.2	0.48 U
1,3-Dichlorobenzene	2.4 U	**0.86**	22 U	2.4	NE	0.48 U	**0.23 J**	0.48 U	2.2	0.48 U
1,4-Dichlorobenzene	2.4 U	0.48 U	22 U	5.5	NE	**0.16 J**	**0.35 J**	0.48 U	1.2	0.48 U
Dichlorodifluoromethane	**4.2**	**3.1**	18 U	16.5	NE	**3**	**2.9**	**3**	8.1	**3.1**
1,1-Dichloroethane	1.6 U	0.32 U	15 U	0.7	NE	0.32 U	0.32 U	0.32 U	0.6	0.32 U

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Former Skillman Street Holder Station Site
Brooklyn, New York

	Soil Vapor			EPA BASE Indoor Air Concentrations 90th Percentile[1]	NYSDOH Air Guidance Value	Indoor Air			EPA BASE Outdoor Air Concentrations 90th Percentile[1]	Outdoor Air
Sample Name:	SSSV-01	Duplicate of SSSV-01	SSSV-02			SSIA-01	Duplicate of SSIA-01	SSIA-02		SSOA-01
Sample Date:	3/25/2011	3/25/2011	3/24/2011			3/25/2011	3/25/2011	3/25/2011		3/25/2011
1,2-Dichloroethane	1.6 U	**0.4**	15 U	0.9	NE	**0.17 J**	**0.21 J**	**0.096 J**	0.8	**0.11 J**
cis-1,2-Dichloroethene	1.6 U	0.32 U	**1500**	1.9	NE	0.32 U	0.32 U	0.32 U	1.8	0.32 U
trans-1,2-Dichloroethene	1.6 U	0.32 U	**68**	NE	NE	0.32 U	0.32 U	0.32 U	NE	0.32 U
1,1-Dichloroethene	1.6 U	0.32 U	14 U	1.4	NE	0.32 U	0.32 U	0.32 U	1.4	0.32 U
1,2-Dichloropropane	1.8 U	0.37 U	17 U	1.6	NE	0.37 U	0.37 U	0.37 U	1.6	0.37 U
cis-1,3-Dichloropropene	1.8 U	0.36 U	17 U	2.3	NE	0.36 U	0.36 U	0.36 U	2.2	0.36 U
trans-1,3-Dichloropropene	1.8 U	0.36 U	17 U	1.3	NE	0.36 U	0.36 U	0.36 U	1.4	0.36 U
1,4-Dioxane	3.6 U	0.72 U	33 U	NE	NE	0.72 U	0.72 U	0.72 U	NE	0.72 U
Ethanol	**49 J**	**63 J**	**120 J**	210	NE	**450 J**	**420 J**	**370 J**	57	**35 J**
2-Ethylthiophene	1.8 UJ	0.37 UJ	17 UJ	NE	NE	0.37 UJ	0.37 UJ	0.37 UJ	NE	0.37 UJ
p-Ethyltoluene	**2.6 J**	**2.8**	36 U	3.6	NE	**0.65 J**	**0.56 J**	**0.49 J**	3	0.79 U
n-Heptane	**3 J**	**3.3**	37 U	NE	NE	**1.2**	**1.1**	**0.41 J**	NE	**0.3 J**
Hexachlorobutadiene	21 U	4.3 U	190 U	6.8	NE	4.3 U	**0.61 J**	4.3 U	6.4	4.3 U
n-Hexane	**3 J**	**3.1**	32 U	10.2	NE	**9.8 J**	**2.3 J**	**0.94**	6.4	**0.89**
2-Hexanone	**0.99 J**	**1.1**	37 U	NE	NE	**0.28 J**	**0.25 J**	**0.22 J**	NE	0.82 U
Methyl tert-butyl ether	7.2 U	1.4 U	66 U	11.5	NE	1.4 U	1.4 U	1.4 U	6.2	1.4 U
4-Methyl-2-pentanone	**2.2 J**	**3.3**	37 U	6	NE	0.82 U	0.82 U	0.82 U	1.9	0.82 U
Methylene chloride	3.5 U	0.69 U	32 U	10	60	**5.9 J**	0.69 U	**2.2**	6.1	0.69 U
1-Methylnaphthalene	R	R	R	NE	NE	R	R	R	NE	R
2-Methylnaphthalene	R	R	R	NE	NE	R	R	R	NE	R
2-Methylthiophene	1.6 UJ	0.32 UJ	15 UJ	NE	NE	0.32 UJ	0.32 UJ	0.32 UJ	NE	0.32 UJ
3-Methylthiophene	1.6 UJ	0.32 UJ	15 UJ	NE	NE	0.32 UJ	0.32 UJ	0.32 UJ	NE	0.32 UJ
n-Octane	**7**	**8.3**	34 U	4.5	NE	**0.63 J**	**0.71 J**	**0.39 J**	1.6	**0.16 J**
Pentane	**2.8 J**	**3.3**	54 U	NE	NE	**13 J**	**4.3 J**	**1.8**	NE	**1 J**
2-Propanol (Isopropyl Alcohol)	**9.3 J**	**8**	89 U	250	NE	**14**	**13**	**14**	16.5	**2.6**
Styrene	**0.81 J**	**1.1**	15 U	1.9	NE	**0.25 J**	**0.11 J**	0.34 U	1.3	0.34 U
1,1,2,2-Tetrachloroethane	2.7 U	0.55 U	25 U	NE	NE	0.55 U	0.55 U	0.55 U	NE	0.55 U
Tetrachloroethene	**230**	**200**	**12000**	15.9	100	**0.66**	**0.57**	**0.29 J**	6.5	**0.29 J**
1,2,4,5-Tetramethylbenzene	2.2 UJ	**0.92 J**	20 UJ	NE	NE	0.44 UJ	0.44 UJ	0.44 UJ	NE	0.44 UJ
Thiophene	1.4 UJ	0.28 UJ	13 UJ	NE	NE	0.28 UJ	0.28 UJ	0.28 UJ	NE	0.28 UJ
1,1,2-Trichloro-1,2,2-trifluoroethane(Freon-113)	**0.93 J**	**0.64**	28 U	NE	NE	**0.63**	**0.74**	**0.67**	NE	**0.66**
1,2,4-Trichlorobenzene	15 UJ	3 UJ	130 UJ	6.8	NE	3 UJ	**0.4 J**	3 UJ	6.4	3 UJ
1,1,1-Trichloroethane	**6.6**	**6.8**	20 U	20.6	NE	0.44 U	**0.068 J**	0.44 U	2.6	0.44 U
1,1,2-Trichloroethane	2.2 U	0.44 U	20 U	1.5	NE	0.44 U	0.44 U	0.44 U	1.6	0.44 U
Trichloroethene	**1.5**	**1.6**	**1200**	4.2	5	0.21 U	0.21 U	0.21 U	1.3	0.21 U
Trichlorofluoromethane	**1.8 J**	**1.8**	**2.6 J**	18.1	NE	**1.7**	**1.5**	**1.5**	4.3	**1.7**
1,2,3-Trimethylbenzene	**3.3 J**	**4 J**	18 UJ	NE	NE	**0.85 J**	0.39 UJ	**0.76 J**	NE	0.39 UJ
1,3,5-Trimethylbenzene	**3.7 J**	**8.5 J**	18 U	3.7	NE	**0.58**	**0.36 J**	**0.47**	2.7	0.39 U
2,2,4-Trimethylpentane	**0.48 J**	**0.34 J**	42 U	NE	NE	**0.59 J**	**0.42 J**	**0.34 J**	NE	**0.35 J**
Vinyl bromide	1.7 U	0.35 U	16 U	NE	NE	0.35 U	0.35 U	0.35 U	NE	0.35 U
Vinyl chloride	1 U	0.2 U	9.3 U	1.9	NE	0.2 U	0.2 U	0.2 U	1.8	0.2 U
Other (%)										
Helium	0.17 U	0.21 U	**0.83**	NE	NE	NA	NA	NA	NE	NA

GEI Consultants

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Skillman_Air_Table_062411
NewYork_Air

Notes:

ug/m^3 - micrograms per cubic meter
Possibly MGP-Related VOCs (ug/m3)
VOCs - volatile organic compounds

BASE Reference [1] Source: NYSDOH, October 2006. Summary of Indoor and Outdoor Levels of Volatile Organic Compounds from selected public and commercial office buildings reported in various locations within office settings in NYS, 1994-1996.

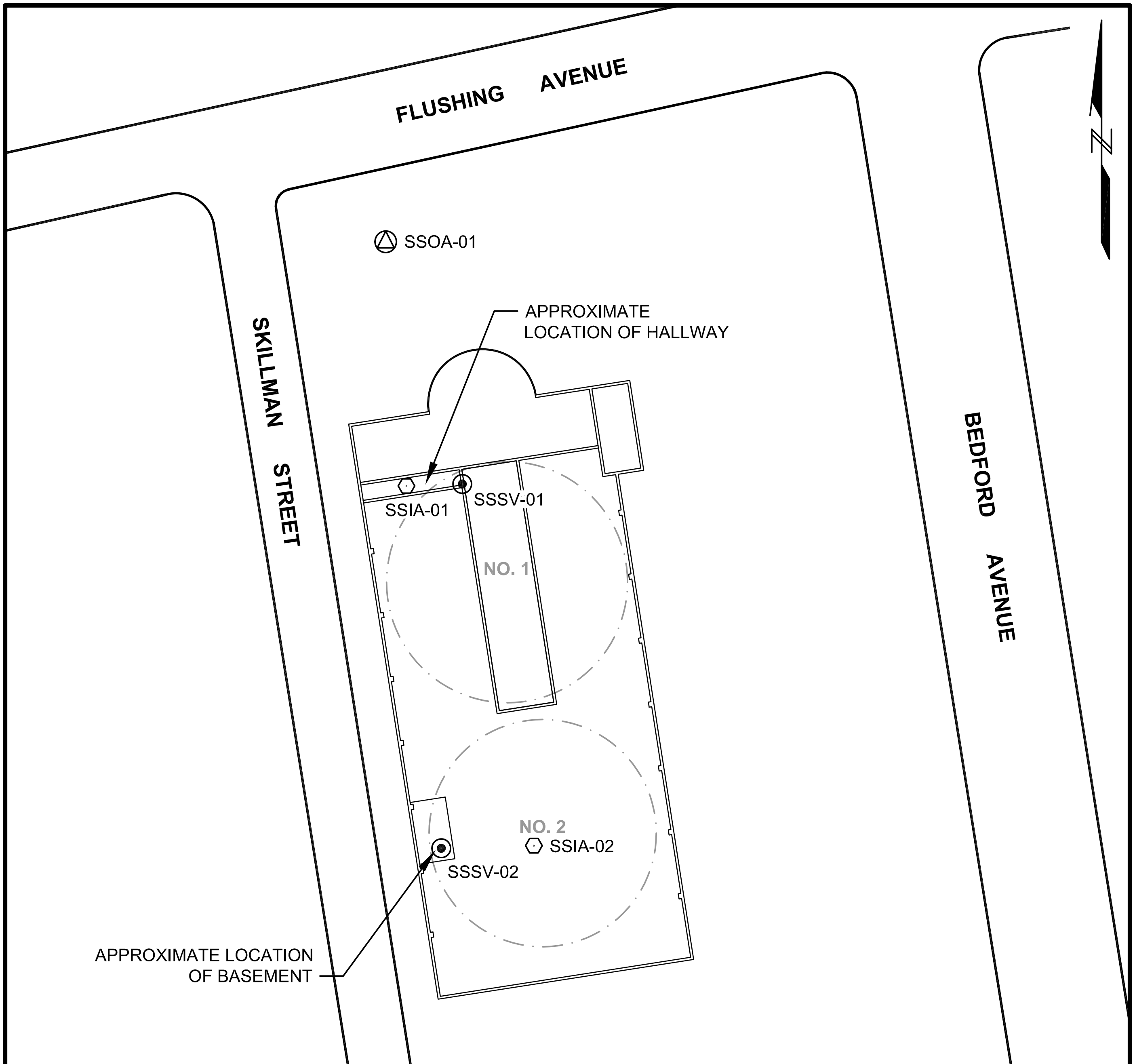
NE - not established
NA - not analyzed

Bolding indicates a detected result concentration
Shading and bolding indicates that the detected concentration is above the 90th percentile of the EPA BASE value (Background Concentration) it was compared to.

Validation Qualifiers:

J - estimated value
U - not detected at or above the reporting limit shown
UJ - not detected at or above the reporting limit shown and the reporting limit is estimated

FIGURE



SOURCES:

1. STREETS AND BUILDING PLACEMENT BASED ON PHOTOGRAPH OBTAINED FROM BLUE SKY INTERNATIONAL LTD. ALL RIGHTS RESERVED. COPYRIGHT 2006.
2. BUILDING FOOTPRINT FROM: *SHEET 2 OF 3, 7-23 SKILLMAN STREET, BROOKLYN, NY,* PREPARED BY HAROLD WEINBERG P.E. CONSULTING ENGINEER P.C., BROOKLYN, NY, SCALE: 1"=20', DATE: 11/26/03.
3. SURVEY OF SAMPLE LOCATIONS CONDUCTED BY GEI CONSULTANTS, INC. SURVEYED BY NEW YORK STATE-LICENSED LAND SURVEYOR NO. 050146.

0 60 120

SCALE, FEET

LEGEND:

	HISTORIC GAS HOLDER LOCATION
SSSV-01	SOIL VAPOR SAMPLE LOCATION
SSIA-01	INDOOR AIR SAMPLE LOCATION (APPROXIMATE)
SSOA-01	OUTDOOR AIR SAMPLE LOCATION (APPROXIMATE)

SITE CHARACTERIZATION - 7 SKILLMAN STREET
SKILLMAN STREET HOLDER STATION SITE
BROOKLYN, NEW YORK

nationalgrid

GEI Consultants

SAMPLE LOCATIONS

Project 093080-1-1105 | July 2011 | Figure 1

I:\Project\National Grid\Skillman Street\093080\SCWP-Alternate\Drawings\06-2011\ Skillman St-Proposed Samples.dwg \Jul 15, 2011

ATTACHMENT

Soil Vapor / Indoor Air Matrix 1

October 2006

	INDOOR AIR CONCENTRATION of COMPOUND (mcg / m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg / m^3)	< 0.25	0.25 to < 1	1 to < 5.0	5.0 and above
< 5	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
5 to < 50	5. No further action	6. MONITOR	7. MONITOR	8. MITIGATE
50 to < 250	9. MONITOR	10. MONITOR / MITIGATE	11. MITIGATE	12. MITIGATE
250 and above	13. MITIGATE	14. MITIGATE	15. MITIGATE	16. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 1

This matrix summarizes the minimum actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 0.25 microgram per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples, a minimum reporting limit of 5 micrograms per cubic meter is recommended for buildings with full slab foundations, and 1 microgram per cubic meter for buildings with less than a full slab foundation.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions may be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the soil vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

Soil Vapor / Indoor Air Matrix 2

October 2006

	INDOOR AIR CONCENTRATION of COMPOUND (mcg / m^3)			
SUB-SLAB VAPOR CONCENTRATION of COMPOUND (mcg / m^3)	< 3	3 to < 30	30 to < 100	100 and above
< 100	1. No further action	2. Take reasonable and practical actions to identify source(s) and reduce exposures	3. Take reasonable and practical actions to identify source(s) and reduce exposures	4. Take reasonable and practical actions to identify source(s) and reduce exposures
100 to < 1,000	5. MONITOR	6. MONITOR / MITIGATE	7. MITIGATE	8. MITIGATE
1,000 and above	9. MITIGATE	10. MITIGATE	11. MITIGATE	12. MITIGATE

No further action:
Given that the compound was not detected in the indoor air sample and that the concentration detected in the sub-slab vapor sample is not expected to significantly affect indoor air quality, no additional actions are needed to address human exposures.

Take reasonable and practical actions to identify source(s) and reduce exposures:
The concentration detected in the indoor air sample is likely due to indoor and/or outdoor sources rather than soil vapor intrusion given the concentration detected in the sub-slab vapor sample. Therefore, steps should be taken to identify potential source(s) and to reduce exposures accordingly (e.g., by keeping containers tightly capped or by storing volatile organic compound-containing products in places where people do not spend much time, such as a garage or outdoor shed). Resampling may be recommended to demonstrate the effectiveness of actions taken to reduce exposures.

MONITOR:
Monitoring, including sub-slab vapor, basement air, lowest occupied living space air, and outdoor air sampling, is needed to determine whether concentrations in the indoor air or sub-slab vapor have changed. Monitoring may also be needed to determine whether existing building conditions (e.g., positive pressure heating, ventilation and air-conditioning systems) are maintaining the desired mitigation endpoint and to determine whether changes are needed. The type and frequency of monitoring is determined on a site-specific and building-specific basis, taking into account applicable environmental data and building operating conditions. Monitoring is an interim measure required to evaluate exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MITIGATE:
Mitigation is needed to minimize current or potential exposures associated with soil vapor intrusion. The most common mitigation methods are sealing preferential pathways in conjunction with installing a sub-slab depressurization system, and changing the pressurization of the building in conjunction with monitoring. The type, or combination of types, of mitigation is determined on a building-specific basis, taking into account building construction and operating conditions. Mitigation is considered a temporary measure implemented to address exposures related to soil vapor intrusion until contaminated environmental media are remediated.

MONITOR / MITIGATE:
Monitoring or mitigation may be recommended after considering the magnitude of sub-slab vapor and indoor air concentrations along with building- and site-specific conditions.

See additional notes on page 2.

ADDITIONAL NOTES FOR MATRIX 2

This matrix summarizes the minimum actions recommended to address current and potential exposures related to soil vapor intrusion. To use the matrix appropriately as a tool in the decision-making process, the following should be noted:

[1] The matrix is generic. As such, it may be appropriate to modify a recommended action to accommodate building-specific conditions (e.g., dirt floor in basement, crawl spaces, etc.) and/or factors provided in Section 3.2 of the guidance (e.g., current land use, environmental conditions, etc.). For example, resampling may be recommended when the matrix indicates "no further action" for a particular building, but the results of adjacent buildings (especially sub-slab vapor results) indicate a need to take actions to address exposures related to soil vapor intrusion. Additionally, actions more protective of public health than those specified within the matrix may be proposed at any time. For example, the party implementing the actions may decide to install sub-slab depressurization systems on buildings where the matrix indicates "no further action" or "monitoring." Such an action is usually undertaken for reasons other than public health (e.g., seeking community acceptance, reducing excessive costs, etc.).

[2] Actions provided in the matrix are specific to addressing human exposures. Implementation of these actions does not preclude investigating possible sources of vapor contamination, nor does it preclude remediating contaminated soil vapors or the source of soil vapor contamination.

[3] Appropriate care should be taken during all aspects of sample collection to ensure that high quality data are obtained. Since the data are being used in the decision-making process, the laboratory analyzing the environmental samples must have current Environmental Laboratory Approval Program (ELAP) certification for the appropriate analyte and environmental matrix combinations. Furthermore, samples should be analyzed by methods that can achieve a minimum reporting limit of 3 micrograms per cubic meter for indoor and outdoor air samples. For sub-slab vapor samples, a minimum reporting limit of 5 micrograms per cubic meter is recommended.

[4] Sub-slab vapor and indoor air samples are typically collected when the likelihood of soil vapor intrusion to occur is considered to be the greatest (i.e., worst-case conditions). If samples are collected at other times (typically, samples collected outside of the heating season), then resampling during worst-case conditions may be appropriate to verify that actions taken to address exposures related to soil vapor intrusion are protective of human health.

[5] When current exposures are attributed to sources other than soil vapor intrusion, the agencies should be given documentation (e.g., applicable environmental data, completed indoor air sampling questionnaire, digital photographs, etc.) to support a proposed action other than that provided in the matrix box and to support agency assessment and follow-up.

[6] The party responsible for implementing the recommended actions will differ depending upon several factors, including the identified source of the volatile chemicals, the environmental remediation program, and site-specific and building-specific conditions. For example, to the extent that all site data and site conditions demonstrate that soil vapor intrusion is not occurring and that the potential for soil vapor intrusion to occur is not likely, the soil vapor intrusion investigation would be considered complete. In general, if indoor exposures represent a concern due to indoor sources, then the State will provide guidance to the property owner and/or tenant on ways to reduce their exposure. If indoor exposures represent a concern due to outdoor sources, then the NYSDEC will decide who is responsible for further investigation and any necessary remediation. Depending upon the outdoor source, this responsibility may or may not fall upon the party conducting the soil vapor intrusion investigation.

Felter, Melissa

From:	Scott Deyette <sxdeyett@gw.dec.state.ny.us>
Sent:	Monday, July 18, 2011 1:31 PM
To:	Jane O'Connell; Robert Cozzy
Cc:	Bridget Callaghan; Campbell, Donald
Subject:	NG Skillman St MGP Site, #224068, Chlorinated Solvent Detections
Attachments:	letter.hw224068.2011-07-17.NGtoRoth_SVIResults_7Skillman.pdf

Bob/Jane-

I have attached a letter that National Grid delivered yesterday to a property owner where, during the site characterization of the former MGP, chlorinated compound detections were found in the sub slab soil vapor investigation. These compounds are obviously not MGP-related and National Grid will not be asked to determine their origin. Should you have any questions regarding the site please give me a call. Thanks.

R. Scott Deyette
Chief, Inspection Unit
Remedial Bureau C
NYSDEC
(518) 402-9662

Appendix E

Boring and Monitoring Well Construction Logs

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

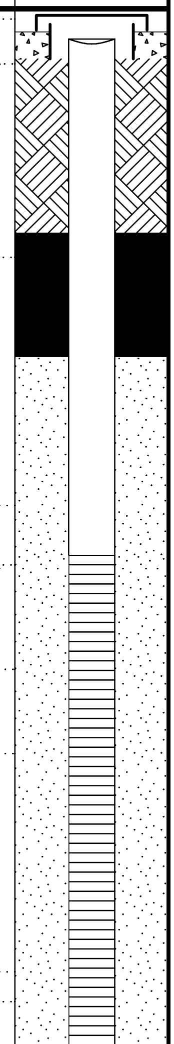
BORING LOG

SSGP-02

GROUND SURFACE ELEVATION (FT): 19.39
LOCATION: Sidewalk on Skillman Street
NORTHING: 679759 **EASTING:** 642453.76
TOTAL DEPTH (FT): 40.00
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt
DATE START / END: 8/10/2010 - 8/11/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 9.29 9/9/2011 Water level measured in well casing (pvc)

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0		5.0		272.0			CrLO CrLO	SSGP-02 (0.5-5)	CONCRETE; 2.5" thick, HAND-CLEARED. (0.2'- 1.1') SILTY SAND (SM); ~80% sand, fine to medium, ~10% gravel, fine, ~10% fines; slight creosote-like odor, moist, dark brown, HAND-CLEARED. (1.1'- 5') SANDY SILT WITH GRAVEL (ML); ~50% fines, low plasticity, rapid dilatancy, ~30% sand, fine to medium, ~20% gravel, fine to coarse; trace brick fragments, moderate creosote-like odor, moist, brown and dark brown, HAND-CLEARED.
5	S-1	5.0	47						(5'- 10') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~75% sand, fine to coarse, ~15% gravel, fine to coarse, ~10% fines; max. size 2.5 in., dry, brown, crushed boulder/gravel from ~8.2-8.4'.
⊻									
10	S-2	5.0	41	182.0					(10'- 11.2') WIDELY GRADED SAND WITH SILT (SW-SM); ~85% sand, fine to coarse, ~10% fines, ~5% gravel, fine to coarse; max. size 1 in., dry, brown, crushed boulder/gravel from ~10.8-11.2'. (11.2'- 13.3') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine to coarse, subangular, ~5% fines; brown to reddish brown, crushed boulder/gravel from ~12.5-13.3'. (13.3'- 15') SILTY SAND (SM); ~75% sand, fine to coarse, ~25% fines; wet, brown, pocket of gray clay.
15	S-3	5.0	42						(15'- 19.4') SILTY SAND (SM); ~75% sand, fine to coarse, ~20% fines, ~5% gravel; wet, brown. (19.4'- 20') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, brown.
20	S-4	5.0	31						(20.2'- 24') WIDELY GRADED SAND WITH SILT (SW-SM); ~85% sand, fine to coarse, ~10% fines, ~5% gravel, fine; wet, brown, top 2 inches is fine to medium silty sand.

WELL ID: **SSMW-02**
CONSTRUCTION DETAILS



NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET
NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR
NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-02

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				648.0			NLO		(24'- 25') WIDELY GRADED SAND (SW); ~95% sand, fine to medium, ~5% fines; moderate naphthalene-like odor, wet, brown, bands of slight tar sheen.
25	S-5	5.0	30	3725.0			NLO	SSGP-02 (26.7-28.3)	(25'- 28.3') WIDELY GRADED SAND (SW); ~95% sand, fine to coarse, ~5% fines; moderate naphthalene-like odor, wet, brown, bands of slight tar coating from 26.7-28 feet.
							NLO		(28.3'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, wet, brown.
30	S-6	5.0	38				NLO		(30'- 31.2') SILTY SAND (SM); ~80% sand, fine, ~20% fines; slight naphthalene-like odor, moist, brownish gray.
									(31.2'- 35') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% gravel, fine to coarse, ~15% fines; moist, brown to reddish brown, dense.
35	S-7	5.0	19				NLO		(35'- 35.25') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to coarse, ~35% fines, ~15% gravel, fine to coarse, subangular; slight naphthalene-like odor, moist, brown.
				185.0					(35.25'- 40') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to coarse, ~35% fines, ~15% gravel, fine to coarse, subangular; moist, brown.
40									Bottom of borehole at 40.0 feet.

NOTES:

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IN. = INCHES
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NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED

Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

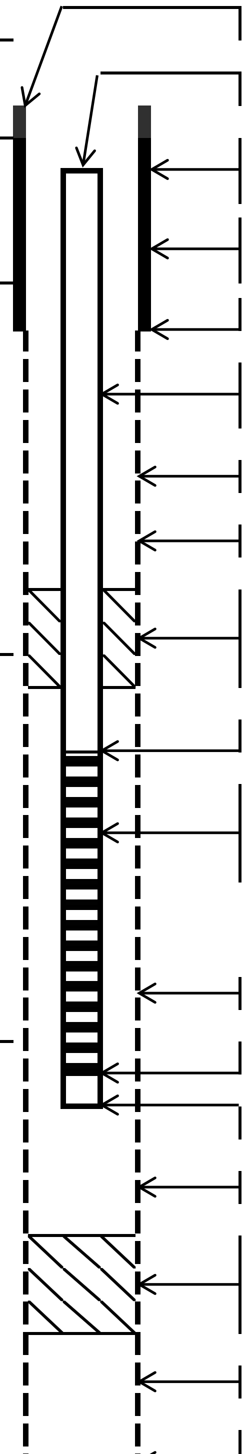
ENVIRONMENTAL BORING LOG SKILLMAN BORINGS.GPJ SKILLMANS.GDT 11/18/11

Groundwater Well Installation Log — SSMW-02

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Skillman St. ROW
Client	National Grid	**N**	679759
Contractor	Zebra Environmental Corporation	**E**	642453.76
Driller	Luke Caballero **GEI Rep.** A. Eberhardt / K. Weber	**Install Date**	8/18/2010

Survey Datum: NAVD 1988

Ground Elevation: 19.39



Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.39 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	1.5 inch ID / 2 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	3.25 inches
Depth Top of Seal	4.5 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	7 feet
Depth Top of Screened Section	11 feet
Type of Screen	Prepacked - Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	1.5 inch ID / 2 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	21 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	n/a
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	21 feet

General Soil Conditions (Not to Scale)

Date	Distance to ▼ below top of riser pipe
5/31/2011	11.38
6/14/2011	11.7
9/9/2011	9.29

Notes:
SSMW-02 was installed in separate borehole, adjacent to SSGP-02 due to observed visual impacts

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-03

GROUND SURFACE ELEVATION (FT): 17.72
LOCATION: Sidewalk on Skillman Street
NORTHING: 679899.34 **EASTING:** 642433.85
TOTAL DEPTH (FT): 15.25
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt
DATE START / END: 8/11/2010 - 8/11/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	SOIL / BEDROCK DESCRIPTION
		5.0					CONCRETE; 6" thick, HAND-CLEARED.
	S-1	9.0	20				(0.5'- 6') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~70% sand, fine to coarse, ~20% gravel, fine to coarse, subangular, ~10% fines; trace brick fragments, max. size 1.25 in., dry, brown, HAND-CLEARED.
5				0.6			(6'- 10') SILTY SAND (SM); ~80% sand, fine to medium, ~15% fines, ~5% gravel, fine, subangular; max. size 0.75 in., moist, brown.
10	S-2	5.0	48				(10'- 12.9') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to medium, ~15% gravel, fine, subangular, ~5% fines; max. size 0.75 in., moist, brown, crushed boulder/gravel, possibly concrete from ~12.4-12.9'.
				0.9			(12.9'- 15.25') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse, subangular; max. size 1.25 in., moist, brown, gold color micaceous flakes in bottom 6 inches.
15							

Refusal at 15.25 feet on possible boulder. Offset ~7 feet North and complete borehole at location SSGP-03A.

NOTES:

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CLO = CHEMICAL LIKE ODOR
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SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR
NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 1 of 2	SSGP-03A

GROUND SURFACE ELEVATION (FT): 17.72 **LOCATION:** Sidewalk on Skillman Street
NORTHING: 679899.34 **EASTING:** 642433.85 **TOTAL DEPTH (FT):** 40.00
DRILLED BY: Luke Caballero **DATUM VERT. / HORZ.:** NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt **DATE START / END:** 8/12/2010 - 8/12/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ▽ 7.05 9/19/2011 Water level measured in well casing (pvc)

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL ID: SSMW-03 CONSTRUCTION DETAILS
0		5.0		0.0			SSGP-03A (0.5-3.5)	CONCRETE; 6" thick, HAND-CLEARED. (0.5'- 3.5') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~70% sand, fine to coarse, ~20% gravel, fine to coarse, subangular, ~10% fines; trace brick fragments, max. size 1.5 in., dry, brown, HAND-CLEARED. (3.5'- 5') WIDELY GRADED GRAVEL WITH SAND (GW); ~60% gravel, fine to coarse, ~35% sand, fine to coarse, ~5% fines; max. size 5 in., moist, brown, cobbles and boulders throughout, HAND-CLEARED.	
5								*See SSGP-03 for detailed soils information for (5'-15').*	
15	S-1	5.0	19	0.5			SSGP-03A (15-17)	(15'- 20') SILTY SAND (SM); ~70% sand, fine to medium, ~25% fines, ~5% gravel, fine to coarse, subangular; moist, brown, 2 inch lens of gravel at 17.1 feet.	
20	S-2	5.0	20					(20'- 25') SILTY SAND (SM); ~70% sand, fine to medium, ~25% fines, ~5% gravel, fine to coarse; max. size 1.5 in., wet, brown, gray crushed boulder/gravel from ~24.1-25'.	

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
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NA = NOT APPLICABLE
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Q_P = POCKET PENETROMETER
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GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-03A

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	
25	S-3	5.0	26	1.1				(25'- 30') SILTY SAND WITH GRAVEL (SM); ~50% sand, mostly fine to medium, ~35% fines, ~15% gravel, mostly coarse; max. size 2.5 in., wet, brown, dark gray crushed boulder/gravel, possibly weathered rock from ~29.8-30'.	
30	S-4	5.0	31	1.3				(30'- 31.9') SILTY SAND (SM); ~90% sand, mostly fine, ~10% fines; wet, brown.	
								(31.9'- 35') SILTY SAND (SM); ~55% sand, fine to coarse, ~35% fines, ~10% gravel, fine to coarse; max. size 1.5 in., wet, brown.	
35	S-5	5.0	26	1.0				(35'- 40') SILTY SAND WITH GRAVEL (SM); ~45% sand, fine to coarse, ~40% fines, ~15% gravel, fine to coarse; max. size 2 in., wet, brown.	
40								Bottom of borehole at 40.0 feet.	

NOTES:

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REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

Groundwater Well Installation Log

SSMW-03

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Skillman St. ROW
Client	National Grid	**N**	679899.34
Contractor	Zebra Environmental Corporation	**E**	642433.85
Driller	Luke Caballero **GEI Rep.** A. Eberhardt / K. Weber	**Install Date**	8/12/2010

Survey Datum: NAVD 1988

Ground Elevation: 17.72

General Soil Conditions (Not to Scale)

Date	Distance to ▼ below top of riser pipe
5/31/2011	9.38
6/14/2011	9.37
9/9/2011	7.05

Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.31 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	1.5 inch ID / 2 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	3.25 inches
Depth Top of Seal	8 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	10 feet
Depth Top of Screened Section	12 feet
Type of Screen	Prepacked - Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	1.5 inch ID / 2 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	22 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	#2 Sand
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	40 feet

Notes:

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-04

GROUND SURFACE ELEVATION (FT): 16.11
LOCATION: Sidewalk on Flushing Avenue
NORTHING: 679947.07 **EASTING:** 642574.04
TOTAL DEPTH (FT): 27.00
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Amy Malsbary and Autumn Eberhardt
DATE START / END: 8/20/2010 - 8/20/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 7.26 9/9/2011 Water level measured in well casing (pvc)

WELL ID: **SSMW-04** CONSTRUCTION DETAILS

DEPTH FT.	TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
		5.0							CONCRETE; 6" thick, HAND-CLEARED.
								SSGP-04 (0.5-5)	(0.5'- 3') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moist, brown, HAND-CLEARED.
				0.0					(3'- 6') SANDY SILT (ML); ~60% fines, ~40% sand, fine; moist, brown, HAND-CLEARED.
5	S-1	5.0	48						
⊻									(6'- 12.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moist, brown, moderate petroleum-like odor and petroleum sheen from ~9.9-10'.
10	S-2	5.0	16	254.0 161.0			PLO	SSGP-04 (9.5-10.5)	
				43.2					(12.5'- 15') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% sand, fine to medium, ~20% gravel, fine to coarse, subangular, ~10% fines; max. size 1 in., wet, brown.
15	S-3	5.0	60						(15'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; wet, brown.
				14.0					
20	S-4	5.0	30						(20'- 21') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% sand, fine, ~20% gravel, coarse, ~10% fines; max. size 1.5 in., moist, brown.
				3.3					(21'- 23') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, coarse, subrounded, ~5% fines; max. size 2 in., wet, brown.

NOTES:

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PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

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IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

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(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

SSGP-04

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25	S-5	2.0	13	4.3					(23'- 25') SILTY SAND (SM); ~75% sand, fine, ~15% fines, ~10% gravel, medium to coarse, subrounded; max. size 1 in., moist, brown. (25'- 27') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine; max. size 0.5 in., moist, brown with red, 2 inch piece of gravel in sample shoe. Refusal at 27.0 feet on possible boulder.

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IN. = INCHES
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TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

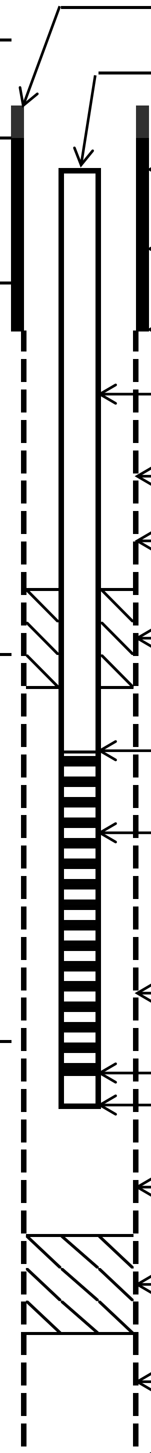
Groundwater Well Installation Log

SSMW-04

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Flushing Ave. ROW
Client	National Grid	**N**	679947.07
Contractor	Zebra Environmental Corporation	**E**	642574.04
Driller	Luke Caballero **GEI Rep.** A. Eberhardt / K. Weber	**Install Date**	8/20/2010

Survey Datum: NAVD 1988

Ground Elevation: 16.11



Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.30 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	1.5 inch ID / 2 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	3.25 inches
Depth Top of Seal	5.5 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	7.5 feet
Depth Top of Screened Section	10 feet
Type of Screen	Prepacked - Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	1.5 inch ID / 2 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	20 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	#2 Sand
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	27 feet

General Soil Conditions (Not to Scale)

Date	Distance to ▼ below top of riser pipe
6/1/2011	8.8
6/14/2011	8.69
9/9/2011	7.26

Notes:

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455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-05

GROUND SURFACE ELEVATION (FT): 20.08
LOCATION: Sidewalk on Bedford Avenue
NORTHING: 679669.91 **EASTING:** 642693.92
TOTAL DEPTH (FT): 28.50
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt
DATE START / END: 8/16/2010 - 8/16/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
		5.0							CONCRETE; 6" thick, HAND-CLEARED.
				0.0				SSGP-05 (0.5-5)	(0.5'- 5') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; moist, reddish brown, HAND-CLEARED.
5	S-1	5.0	9	0.0					(5'- 10') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, subangular, ~10% fines; max. size 2 in., moist, reddish brown.
10	S-2	5.0	42						(10'- 11') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moist, reddish brown, gray crushed boulder/gravel from ~10.8-11'.
				0.0					(11'- 15') SILTY SAND (SM); ~80% sand, fine to medium, rounded, ~15% fines, ~5% gravel; max. size 1 in., moist, reddish brown.
15	S-3	5.0	31					SSGP-05 (15)	(15'- 16') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moist to wet, reddish brown.
				0.0					(16'- 20') SILTY SAND (SM); ~75% sand, fine to medium, ~20% fines, ~5% gravel, fine, subrounded; max. size 0.5 in., moist, reddish brown.
20	S-4	5.0	21	0.0					(20'- 25') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, subangular, ~5% fines; max. size 2 in., moist to wet, reddish brown.

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FT. = FEET
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TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
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Q_P = POCKET PENETROMETER
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GEI Consultants, Inc.
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(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

SSGP-05

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
25	S-5	3.5	26	0.0			PLO		(25'- 28') WIDELY GRADED SAND (SW); ~95% sand, fine to coarse, ~5% fines; slight petroleum-like odor, wet, brown.
									(28'- 28.5') SILTY SAND (SM); ~75% sand, fine to medium, ~20% fines, ~5% gravel, fine to medium; max. size 1 in., moist, reddish brown.
									Refusal at 28.5 feet on possible boulder. Offset ~2 feet North and complete borehole at location SSGP-05A.

NOTES:

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Q_P = POCKET PENETROMETER
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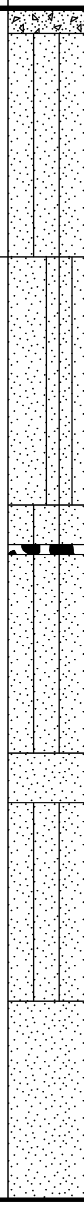
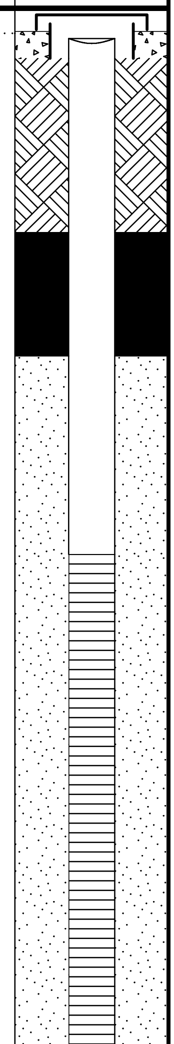
GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 1 of 2 **SSGP-05A**

GROUND SURFACE ELEVATION (FT): 20.08 **LOCATION:** Sidewalk on Bedford Avenue
NORTHING: 679669.91 **EASTING:** 642693.92 **TOTAL DEPTH (FT):** 40.00
DRILLED BY: Luke Caballero **DATUM VERT. / HORZ.:** NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt **DATE START / END:** 8/18/2010 - 8/18/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 13.51 9/9/2011 Water level measured in well casing (pvc)

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL ID: SSMW-05 CONSTRUCTION DETAILS
		5.0		0.5				CONCRETE; 6" thick, HAND-CLEARED. *See SSGP-05 for detailed soils information for (0.5'-25').*	
5									
10									
⊻									
15									
20									

NOTES:

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ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
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BLO = BURNT LIKE ODOR

ENVIRONMENTAL BORING LOG SKILLMAN BORINGS.GPJ SKILLMANS.GDT 11/18/11

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455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-05A

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
25	S-1	5.0	27	0.2				(25'- 29.5') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 2 in., moist, reddish brown, 2 inch gravel piece stuck in tip.
30	S-2	5.0	21	18.2				(29.5'- 32.8') SILTY SAND (SM); ~70% sand, fine to medium, ~25% fines, ~5% gravel, fine to coarse; moist, reddish brown to dark brown.
							NLO	(32.8'- 33.3') SILTY SAND WITH GRAVEL (SM); ~40% gravel, fine to coarse, subangular, ~40% sand, fine to coarse, ~20% fines; max. size 1.5 in., moist, reddish brown to dark brown.
35	S-3	5.0	35	6.5			NLO	(33.3'- 35') SILTY SAND (SM); ~70% sand, fine to medium, ~25% fines, ~5% gravel, fine to coarse; slight naphthalene-like odor, moist, reddish brown, odor is possible mix with petroleum-like odor; odor decreases with depth.
								(35'- 38') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to medium, ~25% fines, ~20% gravel, fine to coarse; max. size 1 in., slight naphthalene-like odor, moist, reddish brown.
40								(38'- 40') SILTY SAND WITH GRAVEL (SM); ~55% sand, fine to medium, ~25% fines, ~20% gravel, fine to coarse; max. size 1 in., moist, reddish brown.

Bottom of borehole at 40.0 feet.

NOTES:

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NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

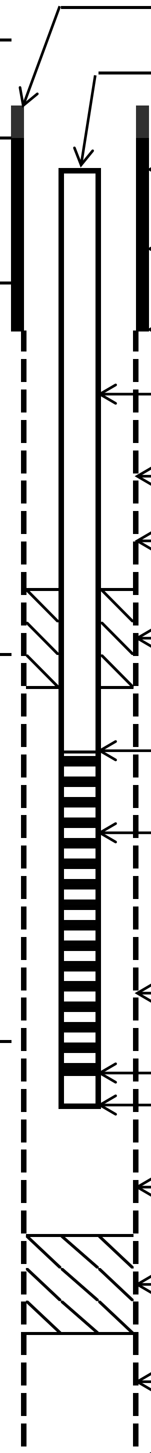
Groundwater Well Installation Log

SSMW-05

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Bedford Ave. ROW
Client	National Grid		**N** 679669.91
Contractor	Zebra Environmental Corporation		**E** 642693.92
Driller	Luke Caballero **GEI Rep.** A. Eberhardt / K. Weber	**Install Date**	8/18/2010

Survey Datum: NAVD 1988

Ground Elevation: 20.08



Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.40 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	1.5 inch ID / 2 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	3.25 inches
Depth Top of Seal	8 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	10 feet
Depth Top of Screened Section	12 feet
Type of Screen	Prepacked - Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	1.5 inch ID / 2 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	22 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	#2 Sand
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	40 feet

General Soil Conditions (Not to Scale)

Date	Distance to ▼ below top of riser pipe
6/1/2011	15.98
6/14/2011	14.98
9/9/2011	13.51

Notes:

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

SSGP-06

GROUND SURFACE ELEVATION (FT): 19.14
LOCATION: 7 Skillman: to the North outside Holder 1
NORTHING: 679849.53 **EASTING:** 642471.9
TOTAL DEPTH (FT): 32.00
DRILLED BY: Lukas Reiss
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz and Nick Morang
DATE START / END: 6/27/2013 - 6/27/2013
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 15.00 6/27/2013 12:45 pm Water level

DEPTH FT.	TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
				1.5				Env. Sample ID= SSGP-06 (3-3.5)	(0'- 2.5') NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% sand, fine to medium, ~15% gravel, fine to coarse, ~5% fines; dry, dark brown, FILL, brick fragments and glass shards, hand cleared.
									(2.5'- 3') FILL; dry, brick and concrete fragments, hand cleared.
							NLO		(3'- 5') NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% sand, fine to medium, ~15% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, dry, dark brown, FILL, brick fragments and glass shards, hand cleared.
5	S-1	5.0	4.1	3.3			NLO		(5'- 7.6') NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% sand, fine to medium, ~15% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 0.75 in., slight naphthalene-like odor, dry, brown, FILL, coarse gravel layer ~6.8-7.1'.
									(7.6'- 8') FILL; gray, concrete fragments.
							NLO		(8'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, subrounded and subangular, ~5% fines; slight naphthalene-like odor, dry, brown, FILL.
10	S-2	5.0	2.5	0.0			NLO		(10'- 11.2') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, subrounded and subangular, ~5% fines; slight naphthalene-like odor, dry, brown, FILL.
									(11.2'- 12') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, fine to coarse, ~5% fines; dry, dark brown, FILL, traces of black staining.
							OLO		(12'- 15') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, fine to coarse, subrounded and subangular, ~5% fines; moderate organic-like odor, brown, FILL, brick fragments ~14.0-15.0'; bottom of the macrocore is moist, no odor.
⊻ 15	S-3	5.0	3.5	0.0			NLO	Env. Sample ID= SSGP-06 (15-17)	(15'- 18.1') NARROWLY GRADED SAND (SP); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, subrounded and subangular, ~5% fines; slight naphthalene-like odor, wet, brown, FILL, brick fragments ~17.0-17.1'.
							NLO		(18.1'- 19.5') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, wet, brown, traces of fine gravel.
							NLO		(19.5'- 20') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; slight naphthalene-like odor, wet, brown, traces of medium sand.
20	S-4	5.0	4.8	0.0					(20'- 22.6') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; max. size 0.25 in., wet, brown, sand is predominantly medium-grained.
									(22.6'- 23.9') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; max.

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GEI Consultants
GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-06

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
							NLO		size 0.25 in., wet, brown, layers of reddish-brown fine sand ~23.1-24.0'; interval of brown silt consisting of ~90% fines and ~10% fine sand ~23.6-24.0'. (23.9'- 24.3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; max. size 0.25 in., wet, brown, slight dark gray staining.
25	S-5	5.0	4.8	0.0			NLO		(24.3'- 25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; max. size 0.25 in., slight naphthalene-like odor, wet, brown. (25'- 27.9') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, wet, brown, traces of mica; traces of coarse angular gravel.
							NLO		(27.9'- 29.7') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine, subrounded and subangular; max. size 0.25 in., slight naphthalene-like odor, wet, brown, slight musty-like odor.
							NLO		(29.7'- 30') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, subrounded and angular, ~5% fines; max. size 1 in., slight naphthalene-like odor, wet, brown, slight musty-like odor.
30	S-6	2.0	2.0	0.0			NLO	Env. Sample ID= SSGP-06 (31-32)	(30'- 31') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, wet, brown, traces of coarse sand and fine gravel, slight musty-like odor.
							NLO		(31'- 32') NARROWLY GRADED SAND (SP); ~90% sand, fine, ~5% gravel, fine to coarse, rounded, subrounded and subangular, ~5% fines; max. size 0.25 in., slight naphthalene-like odor, wet to moist, brown, traces of medium sand; 0.3' in shoe. Refusal at 32.0 feet.

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455 Winding Brook Road
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CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-06B

GROUND SURFACE ELEVATION (FT): 19
LOCATION: 7 Skillman: to the North outside Holder 1
NORTHING: 679851.93 **EASTING:** 642471.72
TOTAL DEPTH (FT): 34.00
DRILLED BY: Lukas Reiss
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz and Nick Morang
DATE START / END: 6/28/2013 - 6/28/2013
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ▼ 11.83 6/28/2013 10:05 am Water level

DEPTH FT.	TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	ODOR	SOIL / BEDROCK DESCRIPTION
0				NA		(0'- 2.5') NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% sand, fine to medium, ~15% gravel, fine to coarse, ~5% fines; dry, dark brown, FILL, brick fragments and glass shards, hand cleared.
						(2.5'- 3') FILL; dry, brick, concrete, coal fragments, hand cleared.
					NLO	(3'- 5') NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% sand, fine to medium, ~15% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, dry, dark brown, FILL, brick fragments and glass shards, hand cleared.
5	S-1	5.0	1.5	0.0		(5'- 10') NARROWLY GRADED SAND WITH GRAVEL (SP); ~80% sand, fine to medium, ~15% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 0.5 in., dry, brown, FILL.
10	S-2	5.0	3.4	0.1	NLO	(10'- 11') NARROWLY GRADED SAND (SP); fine to coarse, subrounded and subangular, ~95% sand, fine to medium, ~5% fines; dry, brown, FILL. Slight staining ~10.9-11.0'. (11'- 11.9') NARROWLY GRADED SAND (SP); fine to coarse, subrounded and subangular, ~95% sand, fine to medium, ~5% fines; dry, brown, FILL. (11.9'- 12.6') WIDELY GRADED GRAVEL WITH SAND (GW); ~50% gravel, fine to coarse, subrounded and subangular, ~45% sand, fine to medium, ~5% fines; max. size 0.75 in., dry, brown, FILL, brick fragments. (12.6'- 13.8') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subrounded and subangular; max. size 0.5 in., moist, brown, FILL, firm. (13.8'- 14.1') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moist, light brown, FILL, trace mica. (14.1'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine, angular, subrounded and subangular; moist to wet, brown, FILL, brick fragments ~14.4-14.6'.
15	S-3	5.0	1.9	0.5	NLO	(15'- 18.4') NARROWLY GRADED SAND (SP); ~100% sand, fine to medium; wet, brown, FILL, water saturated ~15.0-16.3'; wet ~16.6-18.4'. (18.4'- 19.5') WIDELY GRADED GRAVEL WITH SAND (GW); ~50% gravel, fine to coarse, subrounded and subangular, ~45% sand, fine to medium, ~5% fines; max. size 0.75 in., dry, brown, FILL.
20	S-4	5.0	2.7	1.5	NLO	(19.5'- 20') WIDELY GRADED GRAVEL WITH SAND

WELL ID:
CONSTRUCTION DETAILS

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GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Skillman Street Holder Station CITY/STATE: Brooklyn, New York GEI PROJECT NUMBER: 093080-1-1101	BORING LOG PAGE 2 of 2 SSGP-06B

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR
							NLO
25	S-5	5.0	4.4	53.3			NLO
							NLO
							NLO
30	S-6	4.0	1.3	NA			NLO
							NLO

SOIL / BEDROCK DESCRIPTION

(GW); fine to coarse, subrounded and subangular, ~45% sand, fine to medium, ~5% fines; ~50% coal, max. size 0.75 in., slight naphthalene-like odor, wet, brown, FILL.

(20'- 25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, subrounded, ~5% fines; max. size 0.75 in., slight naphthalene-like odor, brown, water saturated ~20.0-23.7', wet ~23.7-25.0'; layer of coarse subrounded gravel.

(25'- 28.8') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, subrounded, ~5% fines; max. size 1 in., slight naphthalene-like odor, wet, brown, traces of subangular coarse gravel, max. size equals 1".

(28.8'- 29') NARROWLY GRADED (SP); ~90% sand, fine to medium, ~5% gravel, fine, subrounded, ~5% fines; max. size 1 in., moderate naphthalene-like odor, wet, brown, slight gray staining.

(29'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine, subrounded; max. size 1 in., moderate naphthalene-like odor, wet, brown.

(30'- 32.7') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine to coarse, subangular, ~10% fines; max. size 0.75 in., moderate naphthalene-like odor, wet, brown.

(32.7'- 34') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, wet, brown.

Refusal at 34.0 feet.

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CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-07

GROUND SURFACE ELEVATION (FT): 21.72
LOCATION: 7 Skillman: inside Holder 1 footprint
NORTHING: 679760.74 **EASTING:** 642511.75
TOTAL DEPTH (FT): 22.00
DRILLED BY: Lukas Reiss
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz and Nick Morang
DATE START / END: 6/26/2013 - 6/26/2013
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ▼ 9.58 6/26/2013 4:45 pm ▼ 9.42 6/27/2013 8:55 am Water level

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION	WELL ID: CONSTRUCTION DETAILS
0				0.9				Env. Sample ID= SSGP-07 (3-4)	(0'- 1') FILL; dry, gray, concrete. (1'- 1.5') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; dry, black and brown, FILL, chunks of clinker, max. size equals 1", hand cleared. (1.5'- 2') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine and coarse, ~10% fines, ~5% gravel, fine, subrounded and subangular; max. size 0.125 in., dry, brown, FILL, hand cleared. (2'- 5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine and coarse, ~10% fines; dry, brown, FILL, large white concrete-like obstruction at ~1.8'; brick and concrete ~2.0-5.0', hand cleared.	
5	S-1	5.0	2.1	7.2					(5'- 10') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., dry, brown, FILL, pink medium sand and fine gravel at ~6.9'.	
▼ 10	S-2	5.0	1.6	2.2			MLO	Env. Sample ID= SSGP-07 (10-15)	(10'- 15') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., slight musty-like odor, wet, brown and gray, FILL.	
15	S-3	5.0	3.8	9999 (max)			NLO NLO NLO		(15'- 16.8') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., strong naphthalene-like odor, wet, brown and gray, FILL, trace brick fragments. (16.8'- 20') WIDELY GRADED SAND WITH SILT (SW-SM); ~85% sand, fine to coarse, ~10% fines, ~5% gravel, fine to coarse, subrounded and subangular; strong naphthalene-like odor, wet, brown and gray, FILL, light to moderate sheen ~18.0-20.0'.	
20	S-4	2.0	2.0	9999 (max)			NLO NLO	Env. Sample ID= SSGP-07 (20-22)	(20'- 21.2') WIDELY GRADED SAND WITH SILT (SW-SM); ~85% sand, fine to coarse, ~10% fines, ~5% gravel, fine to coarse, subrounded and subangular; max. size 1 in., strong naphthalene-like odor, wet, brown and gray, FILL, thin wood fragments and coal fragments at ~20.9'; light to moderate sheen.	

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GEI Consultants

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CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-07

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
									(21.2'- 22') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, wet, brown, FILL. Refusal at 22.0 feet on possible bottom of holder.

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GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	**CLIENT:** National Grid **PROJECT:** Skillman Street Holder Station **CITY/STATE:** Brooklyn, New York **GEI PROJECT NUMBER:** 093080-1-1101	**BORING LOG** **PAGE** 1 of 2 **SSGP-08**

GROUND SURFACE ELEVATION (FT): 21.87
LOCATION: 7 Skillman: inside Holder 1 footprint
NORTHING: 679724.21 **EASTING:** 642515.37
TOTAL DEPTH (FT): 24.00
DRILLED BY: Lukas Reiss
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz and Nick Morang
DATE START / END: 6/25/2013 - 6/25/2013
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 10.00 6/27/2013 1:35 pm Water level

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
0				0.0				Env. Sample ID= SSGP-08 (3.5-4.5)	(0'- 1') FILL; dry, gray, concrete. (1'- 5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to coarse, ~10% gravel, fine to coarse, ~10% fines; dry, light brown to dark brown, FILL, coarse gravel, brick fragments and coal fragments at ~5.0', hand cleared.
5	S-1	5.0	1.9	NA					(5'- 7.1') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; dry, brown to dark brown, FILL. (7.1'- 7.4') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse, subangular; dry, FILL. (7.4'- 8.5') WIDELY GRADED GRAVEL WITH SAND (GW); ~70% gravel, fine to coarse, subrounded and subangular, ~25% sand, fine to medium, ~5% fines; max. size 1 in., dry, brown and red, FILL, gravel primarily consists of large chunks of brick. (8.5'- 9') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse; dry, FILL, crushed stone. (9'- 10') WIDELY GRADED SAND WITH GRAVEL (SW); ~70% sand, fine to coarse, ~30% gravel, fine to coarse, subrounded and subangular; max. size 1 in., dry to moist, dark brown, FILL.
⊻10	S-2	5.0	2.9	0.0			MLO MLO MLO MLO	Env. Sample ID= SSGP-08 (10-10.5)	(10'- 11.2') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% sand, fine to medium, ~20% gravel, coarse, subrounded and subangular, ~10% fines; max. size 0.75 in., moderate musty-like odor, wet, brown, FILL, trace brick fragments; trace fine gravel, subrounded and subangular;. (11.2'- 12.4') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 0.5 in., moderate musty-like odor, wet, brown, FILL. (12.4'- 13.3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% brick fragments, max. size 1.5 in., moderate musty-like odor, wet, brown, FILL, brick fragments are subrounded and subangular. (13.3'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subangular, ~5% fines; moderate musty-like odor, wet, brown, FILL.
15	S-3	5.0	4.9	0.0			NLO		(15'- 20') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, subangular, ~5% fines; wet, brown, FILL, layers of brick chunks and pulverized brick ~15.3-15.4', 15.8-16.1', 17.2-17.4', 18.3-18.6' and 19.4-19.7'; pulverized rocks and varved rock chunks, max. size equals 1", ~16.5-17.2'; no odor ~15.0-18.2'; slight naphthalene-like odor ~18.3-20.0'.
20	S-4	4.0	4.0	0.0			NLO NLO NLO		(20'- 20.9') WIDELY GRADED SAND (SW); ~95% sand, fine to

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DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
									coarse, ~5% fines; slight naphthalene-like odor, wet, brown, FILL, trace fine gravel. (20.9'- 23.5') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, wet, brown, FILL, brick fragments ~22.7-22.9' and 23.3-23.5'. (23.5'- 24') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, ~5% fines; strong naphthalene-like odor, wet, brown, FILL, portions of black stained material. Refusal at 24.0 feet on possible bottom of holder.

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FT. = FEET

ALO = ASPHALT LIKE ODOR
CLO = CHEMICAL LIKE ODOR
NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
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CrLO= CREOSOTE LIKE ODOR
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GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-09

GROUND SURFACE ELEVATION (FT): 21.81
LOCATION: 7 Skillman: inside Holder 2 footprint
NORTHING: 679662.84 EASTING: 642529.25
TOTAL DEPTH (FT): 26.00
DRILLED BY: Lukas Reiss
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz and Nick Morang
DATE START / END: 6/25/2013 - 6/25/2013
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): 20.75 6/25/2013 12:20 pm 13.91 6/26/2013 10:27 am Water level

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION	WELL ID: CONSTRUCTION DETAILS
0				4.6				Env. Sample ID= SSGP-09 (3-3.4)	(0'- 1') FILL; dry, gray, concrete. (1'- 1.5') WIDELY GRADED GRAVEL (GW); ~100% gravel; dry, gray, FILL, sub-base gravel, hand cleared. (1.5'- 2.5') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine, ~5% fines; dry, brown, FILL, hand cleared. (2.5'- 3') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine, ~5% fines; dry, dark brown, FILL, hand cleared. (3'- 3.4') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., dry, brown, FILL, hand cleared. (3.4'- 5') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 2 in., dry, brown to dark brown, FILL, hand cleared.	
5	S-1	5.0	4.8	2.6			MLO		(5'- 5.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine, ~10% fines, ~5% gravel, fine, subrounded; max. size 0.125 in., dry, light brown, FILL. (5.5'- 6') SILT (ML); ~95% fines, ~5% sand, fine; dry, light brown, FILL, firm; slightly cohesive. (6'- 6.8') SILT (ML); ~95% fines, ~5% sand, fine; slight musty-like odor, dry, dark brown, FILL, firm; slightly cohesive. (6.8'- 9.5') SILT (ML); ~95% fines, ~5% sand, fine; dry, light brown, FILL, slightly cohesive; non-plastic; trace reddish-brown fine sand portions. (9.5'- 11') SILT (ML); ~90% fines, ~10% sand, fine; dry, light brown, FILL, slightly cohesive; non-plastic; crushed light gray gravel 10.9-11'.	
10	S-2	5.0	4.8	65.1			NLO		(11'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); fine to coarse, subrounded and subangular, ~90% sand, fine to medium, ~10% fines; dry, brown, FILL, slight naphthalene-like odor ~14.0-15.0'.	
15	S-3	5.0	4.8	132			NLO NLO	Env. Sample ID= SSGP-09 (16.4-17.4)	(15'- 15.9') NARROWLY GRADED SAND WITH SILT (SP-SM); fine to coarse, subrounded and subangular, ~90% sand, fine to medium, ~10% fines; moist, brown to dark brown, FILL, tiny brick fragments. (15.9'- 16.2') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10%	
20	S-4	5.0	4.7	0.0						

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S_V = TORVANE PEAK
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BORING LOG

SSGP-09

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
25	S-5	1.0	1.0	0.0			CLO		gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 0.75 in., moist, dark brown, FILL. (16.2'- 17.3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 0.5 in., slight naphthalene-like odor, wet to moist, gray and brown, FILL, wet ~16.5-17.6'. (17.3'- 18.3') NARROWLY GRADED SAND (SP); ~85% sand, mostly fine, ~10% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., slight naphthalene-like odor, dry, brown to gray brown, FILL, firm. (18.3'- 20') NARROWLY GRADED SAND (SP); fine, subrounded and subangular, ~95% sand, fine, ~5% fines; dry, brown to reddish brown, FILL, layer of varved gray rock ~19.2-19.4'; brown ~18.8-19.4'; reddish brown ~19.4-19.8'. (20'- 22.8') SILT (ML); ~90% fines, ~10% sand, fine; wet, brown, FILL, trace coarse sand; loose. (22.8'- 23.7') NARROWLY GRADED SAND WITH SILT (SP-SM); subrounded and subangular, ~80% sand, fine to medium, ~20% fines; max. size 0.25 in., dry, red and brown, FILL, traces of coarse gravel, max. size equal to 1", subrounded and subangular. (23.7'- 23.9') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse; max. size 0.5 in., dry, FILL, crushed gravel and stone. (23.9'- 26') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 0.5 in., slight chemical-like odor, moist, brown to gray, FILL. Refusal at 26.0 feet.

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BORING LOG

SSGP-09B

GROUND SURFACE ELEVATION (FT): 21.81
LOCATION: 7 Skillman: inside Holder 2 footprint
NORTHING: 679664.66 **EASTING:** 642528.95
TOTAL DEPTH (FT): 26.50
DRILLED BY: Lukas Reiss
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz and Nick Morang
DATE START / END: 6/26/2013 - 6/26/2013
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 14.00 6/26/2013 9:05 am Water level

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
0				NA					(0'- 1') FILL; dry, gray, concrete, hand cleared.
									(1'- 1.5') WIDELY GRADED GRAVEL; ~100% gravel; dry, gray, FILL, sub-base gravel.
									(1.5'- 5') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., dry, brown, FILL, hand cleared.
5	S-1	5.0	4.9	1.2					(5'- 5.7') SILT WITH SAND (ML); ~75% fines, ~20% sand, fine to medium, ~5% gravel, fine; dry, light brown, FILL, coal ash.
									(5.7'- 9.1') SILT (ML); ~95% fines, ~5% sand, fine; dry, dark brown to light brown, FILL, non-plastic; coarse gravel at ~7.5'.
									(9.1'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine, ~10% fines; dry, light brown, FILL.
10	S-2	5.0	4.9	4.1					(10'- 10.6') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine, subrounded; dry, dark brown, FILL.
									(10.6'- 12.3') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subrounded; dry to moist, light brown, FILL.
									(12.3'- 14') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subrounded; moist to wet, brown and gray, FILL.
⊻							NLO		(14'- 14.2') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subrounded; slight naphthalene-like odor, moist to wet, brown and gray, FILL, gray staining.
							NLO		(14.2'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subrounded and subangular; max. size 0.5 in., slight naphthalene-like odor, moist to wet, brown and gray, FILL, firm.
15	S-3	5.0	4.7	9.4					(15'- 15.9') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moist, brown, FILL.
									(15.9'- 16.3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moist, brown, FILL, trace coal fragments.
							MLO		(16.3'- 19.4') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., slight musty-like odor, moist, gray, FILL.
									(19.4'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subrounded and subangular; max. size 0.5 in., moist, light brown, FILL.
20	S-4	5.0	4.8	13.5					

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BORING LOG

SSGP-09B

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	REMARKS	SOIL / BEDROCK DESCRIPTION
25	S-5	1.5	1.4	4.3			NLO NLO NLO NLO	Env. Sample ID= SSGP-09B (26-26.5)	(20'- 21.3') NARROWLY GRADED SAND WITH SILT (SP-SM); fine, ~90% sand, fine to medium, ~10% fines; brown and gray, FILL. (21.3'- 22.4') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; wet, brown, FILL, traces of fine gravel. (22.4'- 23.2') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; max. size 0.75 in., moist, brown to reddish brown, FILL, gravel primarily consists of brick fragments. (23.2'- 24') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine to coarse, subangular, ~10% fines; max. size 1 in., moist, gray and brown, FILL, firm; gravel is predominantly coarse; coarse coal fragments. (SP-SM); FILL. (25'- 25.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine to coarse, subangular, ~10% fines; max. size 1 in., slight naphthalene-like odor, moist, gray and brown, FILL, firm; gravel is predominantly coarse. (25.5'- 25.7') NARROWLY GRADED GRAVEL (GP); ~100% gravel, coarse, subrounded; max. size 1.5 in., slight naphthalene-like odor, dry, FILL. (25.7'- 26.5') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, subrounded and subangular, ~5% fines; max. size 1 in., strong naphthalene-like odor, brown, FILL, fine to coarse brick fragments, max. size equals 1" ~26.1-26.3'. Refusal at 26.5 feet.

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BORING LOG

SSGP-14

GROUND SURFACE ELEVATION (FT): 23.48
LOCATION: Sidewalk on Skillman Street
NORTHING: 679569.67 **EASTING:** 642455.67
TOTAL DEPTH (FT): 34.00
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt
DATE START / END: 8/9/2010 - 8/11/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT):

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0		5.0							CONCRETE; 6" thick, HAND-CLEARED.
									(0.5'- 1') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to medium, ~20% fines, ~15% gravel; trace coal, dry, dark brown, HAND-CLEARED.
				0.4				SSGP-14 (3-5)	(1'- 5') SANDY SILT (ML); ~60% fines, non plastic, ~40% sand, fine; dry, brown to orangeish brown, HAND-CLEARED.
5	S-1	5.0	41	0,4					(5'- 10.8') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; dry, orangeish brown and brown, stratified sand in bottom foot of sample.
10	S-2	5.0	60	113.0			PLO PLO	SSGP-14 (12.75-13)	(10.8'- 14') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; wet, brown, slight petroleum-like odor from ~12.6-13.0'. Lens of slight petroleum sheen from ~12.8-13.0'.
15	S-3	5.0	46	3.1			PLO		(14'- 20') LEAN CLAY WITH SAND (CL); ~85% fines, medium plasticity, no dilatancy, ~15% sand, fine; slight petroleum-like odor, moist to wet, brown, slight petroleum-like odor in ~3-4 inch lenses of fine to medium sand spaced ~10-15 inches apart.
20	S-4	5.0	26	1.4					(20'- 22') LEAN CLAY WITH SAND (CL); ~85% fines, medium plasticity, no dilatancy, ~15% sand, fine; moist to wet, brown, laminations of silt lenses.
							PLO		(22'- 23.3') WIDELY GRADED SAND WITH SILT (SW-SM); ~85% sand, fine to coarse, ~10% fines, ~5% gravel, fine to medium; slight petroleum-like odor, wet, brown.

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BORING LOG

SSGP-14

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
									(23.3'- 25') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% fines, ~15% gravel, fine, subangular; moist, reddish brown, dense.
25	S-5	5.0	34	1.4					(25'- 30') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine; moist, brown, 4 inch lens of crushed gravel with coarse sand at ~27.9'.
30	S-6	4.0	32	0.5					(30'- 33.7') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine; max. size 2 in., moist, brown, crushed gravel at bottom of sample.
									(33.7'- 34') BOULDER/COBBLE.

Refusal at 34.0 feet on possible boulder.

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BORING LOG

SSGP-15

GROUND SURFACE ELEVATION (FT): 18.86
LOCATION: Sidewalk on Skillman Street
NORTHING: 679780.97 **EASTING:** 642421.55
TOTAL DEPTH (FT): 40.00
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Kari Weber and Autumn Eberhardt
DATE START / END: 8/19/2010 - 8/19/2010
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 11.10 9/9/2011 Water level measured in well casing (pvc)

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL ID: SSMW-06 CONSTRUCTION DETAILS
									(0'- 0.5') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; dry, brown, HAND-CLEARED.	
				1.2				SSGP-15 (2-5)	(0.5'- 2') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subangular; max. size 2 in., dry, gray to reddish brown, boulder/cobble from ~1.25-2.0', HAND-CLEARED.	
5	S-1	5.0	43	0.2					(5'- 10') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subangular; max. size 2 in., dry, orangeish brown and brown, 3 inch lens of ~20% fines silty sand at ~9.2-9.45'.	
10	S-2	5.0	39						(10'- 11') NARROWLY GRADED SAND (SP); ~90% sand, mostly fine, ~5% gravel, fine, ~5% fines; max. size 0.5 in., moist, brown.	
⊻									(11'- 13.2') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subangular; max. size 1.5 in., dry, brown.	
				272.0			NLO NLO	SSGP-15 (13.5-15)	(13.2'- 14.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subangular; max. size 1.5 in., slight naphthalene-like odor, wet, brown.	

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SSGP-15

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	S-3	5.0	32	199.0			NLO		(14.5'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse, subangular; max. size 1 in., slight naphthalene-like odor, wet, gray.
									(15'- 16') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, wet, brown.
									(16'- 18.9') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, brown.
							OLO BLO		(18.9'- 21') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; wet, grayish brown, 0.25 inch lens of black silt with ~15% fine sand with organic-like odor at 19 feet; burnt-like odor below silt lens.
20	S-4	5.0	19	89.5					
									(21'- 25') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse, subangular; max. size 1.5 in., wet, reddish brown, lens of crushed boulder/gravel from ~22.9-23.0'.
25	S-5	5.0	42						(25'- 30') SILTY SAND WITH GRAVEL (SM); ~60% sand, mostly fine to medium, ~25% fines, ~15% gravel, fine to coarse, subrounded; max. size 1.5 in., wet, brown.
				162.0					
30	S-6	5.0	53				NLO		(30'- 35') SILTY SAND (SM); ~65% sand, fine to coarse, ~25% fines, ~10% gravel, fine to coarse, subangular; max. size 1.5 in., slight naphthalene-like odor, wet, brown, odor decreases with depth.

NOTES:

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REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-15

DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN FT.	SAMPLE INFO: REC FT.	SAMPLE INFO: PID (ppm)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				236.0			NLO		
35	S-7	5.0	31						(35'- 40') SILTY SAND (SM); ~65% sand, fine to coarse, ~25% fines, ~10% gravel, fine to coarse, subangular; max. size 1.5 in., wet, brown.
				118.0					
40									Bottom of borehole at 40.0 feet.

NOTES:

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PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)
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NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK
ppm = PARTS PER MILLION
IN. = INCHES
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NLO = NAPHTHALENE LIKE ODOR
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CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

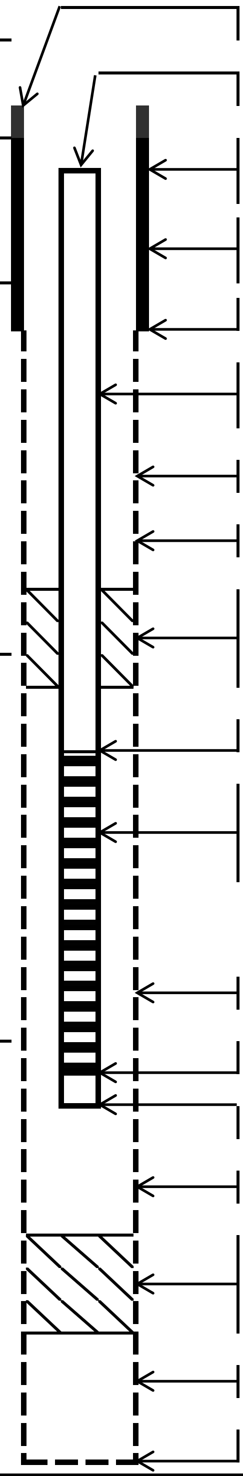
Groundwater Well Installation Log

SSMW-06

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Skillman St. ROW
Client	National Grid		N 679780.97
Contractor	Boart Longyear Company		E 642421.55
Driller	Rick Tabor **GEI Rep.** A. Malsbary / K. Weber	**Install Date**	4/21/2011

Survey Datum: NAVD 1988

Ground Elevation: 18.86



General Soil Conditions (Not to Scale)

Date	Distance to ▼ below top of riser pipe
5/31/2011	12.25
6/14/2011	12.51
9/9/2011	11.1

Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.24 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	2 inch ID / 2.5 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	4.5 inches
Depth Top of Seal	21 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	23 feet
Depth Top of Screened Section	25 feet
Type of Screen	Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	2 inch ID / 2.5 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	30 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	n/a
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	30 feet

Notes:

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

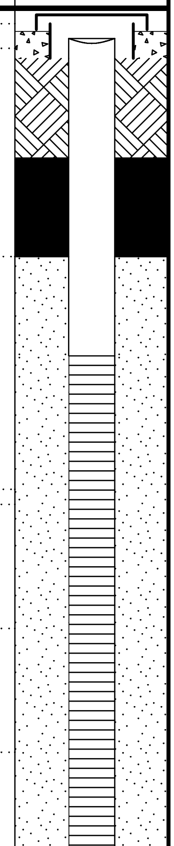
BORING LOG

SSGP-17

GROUND SURFACE ELEVATION (FT): 14.03
LOCATION: Street ROW on Flushing Avenue
NORTHING: 679890.68 **EASTING:** 642277.75
TOTAL DEPTH (FT): 40.00
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Autumn Eberhardt and Erin Regan
DATE START / END: 8/22/2011 - 8/22/2011
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): ⊻ 6.94 9/9/2011 Water level measured in well casing (pvc)

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	S-1	5.0						ASPAHLT; 3.5" thick, HAND-CLEARED.
								CONCRETE; 6" thick, HAND-CLEARED.
								(0.8'- 5') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, subrounded, ~5% fines; max. size 1.5 in., dry, brown, HAND-CLEARED.
5	S-2	5.0	33	0.8				(5'- 9.7') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~70% sand, fine to medium, ~15% gravel, fine to coarse, subangular, ~15% fines; max. size 1.5 in., dry to moist, brown.
⊻								
								(9.7'- 10') SILTY SAND (SM); ~75% sand, fine to coarse, ~20% fines, ~5% gravel; dry to moist, brown, mica.
10	S-3	5.0	51	0.0			SSGP-17 (10-12)	(10'- 12.5') SILTY SAND (SM); ~75% sand, fine to coarse, ~20% fines, ~5% gravel, fine to coarse; max. size 1.75 in., wet, brown, mica, one piece of angular gravel.
								(12.5'- 15') WIDELY GRADED SAND WITH SILT (SW-SM); ~80% sand, fine to coarse, ~10% gravel, fine to coarse, subrounded, ~10% fines; max. size 1 in., moist, brown.
15	S-4	5.0	21	0.2				(15'- 19.3') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~70% sand, fine to coarse, ~20% gravel, fine to coarse, subangular, ~10% fines; max. size 1.5 in., dry to moist, brown.
								(19.3'- 19.5') WIDELY GRADED GRAVEL (GW); ~100% gravel, subrounded; red, weathered and crumbly.
20	S-5	5.0	17	0.7				(19.5'- 20.9') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine, ~5% fines; moist, brown.
								(20.9'- 26.9') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moist, mica; red lenses.

WELL ID: **SSMW-07**
CONSTRUCTION DETAILS



NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL	ppm = PARTS PER MILLION	NLO = NAPHTHALENE LIKE ODOR	CrLO= CREOSOTE LIKE ODOR
REC = RECOVERY LENGTH OF SAMPLE	IN. = INCHES	PLO = PETROLEUM LIKE ODOR	OLO = ORGANIC LIKE ODOR
PID = PHOTOIONIZATION DETECTOR READING (JAR HEADSPACE)	FT. = FEET	TLO = TAR LIKE ODOR	SLO = SULFUR LIKE ODOR
		CLO = CHEMICAL LIKE ODOR	BLO = BURNT LIKE ODOR
		ALO = ASPHALT LIKE ODOR	

NA = NOT APPLICABLE Q_P = POCKET PENETROMETER
NM = NOT MEASURED S_V = TORVANE PEAK

GEI Consultants, Inc.
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(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-17

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	
25	S-6	5.0	32	0.6				(26.9'- 27.7') WIDELY GRADED SAND WITH GRAVEL (SW); ~70% sand, fine to coarse, ~25% gravel, subangular, ~5% fines; brown. (27.7'- 28') NARROWLY GRADED GRAVEL (GP); ~100% gravel; weathered quartz-like gravel, white with crystaline structure. (28'- 30') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% sand, fine to coarse, ~30% gravel, fine to coarse, subrounded, ~10% fines; max. size 1.5 in., dry to moist, brown and reddish brown.	
30	S-7	5.0	0					(30'-35') NO RECOVERY.	
35	S-8	5.0	40	0.0				(35'- 40') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~20% gravel, fine to coarse, subangular, ~20% fines; max. size 1 in., dry to moist, brown, mica.	
40									

Bottom of borehole at 40.0 feet.

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Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

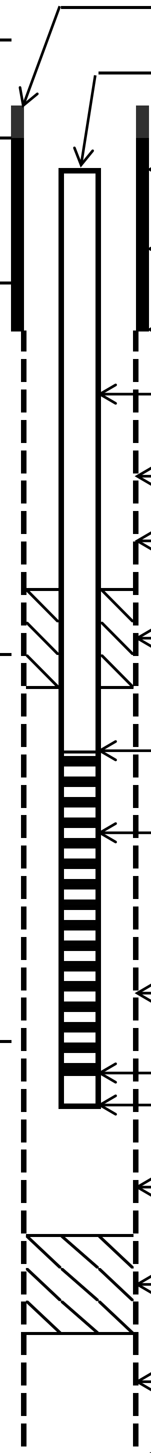
Groundwater Well Installation Log — SSMW-07

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Flushing Ave. ROW
Client	National Grid	**N**	679890.68
Contractor	Zebra Environmental Corporation	**E**	642277.75
Driller	Luke Caballero **GEI Rep.** A. Eberhardt / E. Regan	**Install Date**	8/22/2011

Survey Datum: NAVD 1988

Ground Elevation: 14.03

General Soil Conditions (Not to Scale)



Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.31 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	1.5 inch ID / 2 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	3.25 inches
Depth Top of Seal	3 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	5 feet
Depth Top of Screened Section	7 feet
Type of Screen	Prepacked - Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	1.5 inch ID / 2 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	17 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	#2 Sand
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	40 feet

Date	Distance to ▼ below top of riser pipe
9/9/2011	6.94

Notes:

GEI Consultants

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-18

GROUND SURFACE ELEVATION (FT): 16.61
LOCATION: Sidewalk on Franklin Avenue
NORTHING: 679747.47 **EASTING:** 642211.03
TOTAL DEPTH (FT): 35.00
DRILLED BY: Luke Caballero
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Autumn Eberhardt and Erin Regan
DATE START / END:
DRILLING DETAILS: Geoprobe/5 ft long plastic sleeves / GeoProbe
WATER LEVEL DEPTHS (FT): 9.18 9/9/2011 Water level measured in well casing (pvc)

WELL ID: **SSMW-08**

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	CONSTRUCTION DETAILS
0	S-1	5.0						ASPHALT; 3.5" thick, HAND-CLEARED. CONCRETE; 6" thick, HAND-CLEARED. (0.8'- 5') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, subrounded, ~5% fines; max. size 1.5 in., dry, brown, HAND-CLEARED.	
5	S-2	5.0	46	0.6				(5'- 10') SILTY SAND (SM); ~65% sand, fine to medium, ~30% fines, ~5% gravel; max. size 1 in., dry to moist, brown and reddish brown, FILL, 2" lense of black at bottom.	
10	S-3	5.0	53	1.2			SSGP-18 (10-12)	(10'- 11.3') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; wet, black, FILL, brick fragments, clinker. (11.3'- 15') SILTY SAND WITH GRAVEL (SW-SM); ~60% sand, fine to coarse, ~25% fines, ~15% gravel, subrounded; max. size 1.5 in., moist, brown and reddish brown.	
15	S-4	5.0	50	0.9				(15'- 25') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% sand, fine to coarse, ~30% gravel, subrounded, ~10% fines; max. size 1.5 in., brown to reddish brown, mica, lense of black rock fragments at 24'.	
20	S-5	5.0	46	0.7					

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NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
BLO = BURNT LIKE ODOR

GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSGP-18

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	VISUAL IMPACTS	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	
25	S-6	5.0	33	0.4				(25'- 26.2') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~9% fines, ~5% gravel, subangular; max. size 1.5 in., brown.	
								(26.2'- 33.2') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~60% sand, fine to coarse, ~30% gravel, subrounded, ~10% fines; max. size 1.5 in., brown to reddish brown, mica.	
30	S-7	5.0	41	0.8					
								(33.2'- 35') SILTY SAND (SM); ~70% sand, fine to coarse, ~15% gravel, fine, ~15% fines; brown.	
35									

Refusal at 35.0 feet on possible boulder.

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S_V = TORVANE PEAK

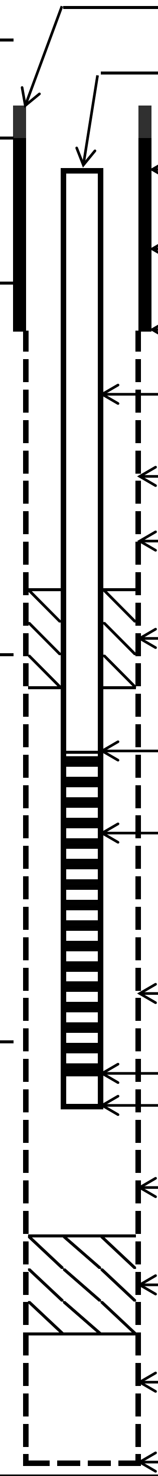
Groundwater Well Installation Log

SSMW-08

Project	Skillman Street Holder Station	**GEI Proj. No.**	093080-1-1101
City / Town	Brooklyn, New York	**Location**	Flushing Ave. ROW
Client	National Grid	**N**	679747.47
Contractor	Zebra Environmental Corporation	**E**	642211.03
Driller	Luke Caballero **GEI Rep.** A. Eberhardt / E. Regan	**Install Date**	8/23/2011

Survey Datum: NAVD 1988

Ground Elevation: 16.61



Length of Surface Casing above Ground	0.0 feet
Dist. Top of Surf. Casing to Top of Riser Pipe	0.23 feet
Type and Thickness of Seal around Surface Casing	6 inches cement
ID of Surface Casing	8 inches
Type of Surface Casing	Road Box
Depth Bottom of Surface Casing	0.9 feet
ID and OD of Riser Pipe	1.5 inch ID / 2 inch OD
Type of Riser Pipe	Sch. 40 PVC
Type of Backfill around Riser Pipe	Grout
Diameter of Borehole	3.25 inches
Depth Top of Seal	3 feet
Type of Seal	Bentonite Chips
Depth Bottom of Seal	5 feet
Depth Top of Screened Section	7 feet
Type of Screen	Prepacked - Sch. 40 PVC
Description of Screen Openings	0.010 inch slots
ID and OD of Screened Section	1.5 inch ID / 2 inch OD
Type of Filter Material	#2 Sand
Depth Bottom of Screened Section	17 feet
Depth Bottom of Silt Trap	n/a
Depth Bottom of Filter Material	#2 Sand
Depth Top of Seal	n/a
Type of Seal	n/a
Depth Bottom of Seal	n/a
Type of Backfill below Filter Material	n/a
Bottom of Borehole	40 feet

General Soil Conditions (Not to Scale)

Date	Distance to ▼ below top of riser pipe
9/9/2011	9.18

Notes:

GEI Consultants

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Suite 201
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(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-19

GROUND SURFACE ELEVATION (FT): 17.16
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679789 **EASTING (FT):** 642570
TOTAL DEPTH (FT): 45.0
DRILLED BY: Danny Ninevski
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/11/2016 - 3/11/2016
DRILLING DETAILS: Sonic Coring / Compact Roto Sonic
WATER LEVEL DEPTHS (FT): ▼ 15.00 3/11/2016 12:20 pm
GENERAL NOTE: Temporary GW point, SSSB-19 (14-24), installed and sampled on 3/11/16

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
15	0	S-1	5/2.3	0.0 0.0 0.1		
10	5	S-2	5/3.7	0.0 0.0 0.0 0.0	NLO	SSSB-19 (7.5-8.5) and a duplicate JHS = 0.0 SSSB-19 GRAB 1
5	10	S-3	5/2	0.0 0.0 0.0	NLO	SSSB-19 GRAB 5 SSSB-19 (13.5-15) SSSB-19 GRAB 2
0	15	S-4	5/1.4	0.0 0.0	NLO NLO	JHS = 1.8
-5	20	S-5	5/2.8	0.0 0.0	NLO NLO NLO	

SOIL / BEDROCK DESCRIPTION

(0'- 0.8') CONCRETE.

(0.8'- 3') SILTY SAND (SM); ~80% sand, fine to medium, ~15% fines, ~5% gravel, fine to coarse; max. size 1, moist to wet, dark brown to brown, FILL.

(3'- 5') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine to coarse, ~5% fines; moist, red brown, coarse brick @ 3', FILL.

(5'- 7.7') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine to coarse; max. size 1, moist, brown, FILL.

(7.7'- 10') SILTY SAND (SM); ~60% sand, fine, ~30% fines, ~10% gravel, fine to coarse; max. size 1.25, slight naphthalene-like odor, moist, brown, brick fragments @ 7.7 - 8.3', trace coal fragments, FILL.

(10'- 11.3') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moist, brown, FILL.

(11.3'- 12.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine to coarse, ~10% fines; max. size 3, moist, brown, FILL.

(12.5'- 15') SANDY SILT (ML); ~60% fines, ~30% sand, fine to medium, ~10% gravel, fine to coarse; max. size 1, slight naphthalene-like odor, moist, brown, FILL.

(15'- 18.5') WIDELY GRADED GRAVEL WTH SAND (GW); ~65% gravel, fine to coarse, ~30% sand, fine to medium, ~5% fines; max. size 2, slight naphthalene-like odor, wet, brown, cobble @ 18.5', FILL.

(18.5'- 20') WIDELY GRADED GRAVEL WTH SAND (GW); ~65% gravel, fine to coarse, ~30% sand, fine to coarse, ~5% fines; max. size 2, slight naphthalene-like odor, wet, white, thin layer of blue-green f-m sand @ 18.5' with moderate NLO, FILL.

(20'- 21.4') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, ~5% fines; max. size 2, slight naphthalene-like odor, wet, brown, FILL.

(21.4'- 22.5') WIDELY GRADED GRAVEL WTH SAND (GW); ~70% gravel, fine to coarse, ~30% sand,

NOTES:

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JHS = JAR HEADSPACE PID READING (PPM)

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FT. = FEET

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CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

GEI Consultants, Inc. P.C.
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-19

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
				0.0	NLO	JHS = 5.0
	25	S-6	5/4			
				0.0		SSSB-19 GRAB 3
-10				0.0	MLO	JHS = 1.5
				0.0		
				0.0	NLO	
	30	S-7	5/3.8			
				0.4		
-15				0.4	NLO	
				1.0		SSSB-19 GRAB 4
				2.6	NLO	SSSB-19 (33-34)
	35	S-8	5/1.5			JHS = 2.0
-20				0.0		
				0.0		
	40	S-9	5/1			
-25				0.0		JHS = 0.3
	45					

SOIL / BEDROCK DESCRIPTION

fine to medium; max. size 2, slight naphthalene-like odor, wet, brownish red, FILL.
(22.5'- 25') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse; max. size 0.75, slight naphthalene-like odor, dry, brown, thin intermittent portions of gray staining, 2-inch concrete @ 28.2', moderate NLO below, FILL.
(25'- 26.75') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, brown, FILL.
(26.75'- 28.1') WIDELY GRADED GRAVEL WTH SAND (GW); ~70% gravel, fine to coarse, ~30% sand, fine to coarse; max. size 3, slight musty-like odor, wet, brown, FILL.
(28.1'- 28.5') COBBLE; FILL.
(28.5'- 30') SILT WITH GRAVEL (ML); ~55% fines, ~25% gravel, fine to coarse, ~20% sand, fine to medium; max. size 2, slight naphthalene-like odor, dry, dark gray to brown, slight chemical-like odor, FILL.
(30'- 34.1') SANDY SILT (ML); ~50% fines, ~35% sand, fine to medium, ~15% gravel, fine to coarse; slight naphthalene-like odor, dry to moist, brown, moderate NLO with depth.
(34.1'- 35') WIDELY GRADED GRAVEL (GW); ~80% gravel, fine to coarse, ~15% sand, fine to coarse, ~5% fines; max. size 1, strong naphthalene-like odor, wet, gray brown, odor increases with depth.
(35'- 40') WIDELY GRADED GRAVEL (GW); ~80% gravel, fine to coarse, ~20% sand, fine to coarse; max. size 3, wet, brown.

(40'- 45') WIDELY GRADED SAND WITH GRAVEL (SW); ~85% sand, fine to coarse, ~15% gravel, fine to coarse; max. size 2, wet, brown.

End of Boring at 45 feet.
Tremie grout from bottom to top.

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S_V = TORVANE PEAK

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IN. = INCHES
FT. = FEET

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CLIENT:	National Grid
PROJECT:	Skillman Street Holder Station
CITY/STATE:	Brooklyn, New York
GEI PROJECT NUMBER:	093080-1-1101

BORING LOG

SSSB-20

GROUND SURFACE ELEVATION (FT): 17.11
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679759 **EASTING (FT):** 642574
TOTAL DEPTH (FT): 40.0
DRILLED BY: William Shinn
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/10/2016 - 3/10/2016
DRILLING DETAILS: Sonic Coring / Small Roto Sonic
WATER LEVEL DEPTHS (FT):
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID
	0		5/NM	NA				JHS = 2.6
15								
	5	S-1	5/3	0.0 0.0 0.0 0.0			NLO	JHS = 132.4 SSSB-20 GRAB 1
10								
	10	S-2	5/4.6	0.0 0.0 0.0 0.0			NLO NLO NLO	JHS = 3.8
5								
	15	S-3	5/4.9	0.0 0.0 0.0 0.0			NLO NLO NLO	JHS = 3 SSSB-20 GRAB 2
0								
	20	S-4	5/3.3	0.0 0.0 0.0			NLO NLO NLO NLO	JHS = 2.2
-5								

SOIL / BEDROCK DESCRIPTION

(0'- 0.8') CONCRETE.

(0.8'- 5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% sand, fine to medium, ~25% gravel, fine to coarse, ~10% fines; dry to moist, brown to red brown, bricks, concrete, cobbles, hand cleared.

(5'- 10') SILTY SAND (SM); ~75% sand, fine, ~20% fines, ~5% gravel, fine to coarse; max. size 1.5, slight naphthalene-like odor, wet, brown, black stained wood chips with strong NLO @ 8.2', moderate NLO to 10'.

(10'- 12.4') SILTY SAND (SM); slight naphthalene-like odor, moist, same as above.

(12.4'- 13.8') SILTY SAND (SM); slight naphthalene-like odor, moist, brown gray, 3-inch cobble @ 12.5', 1/8-inch layer of gray staining @ 13.6'.
(13.8'- 15') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~35% fines, ~15% gravel, fine to coarse; max. size 1.5, slight naphthalene-like odor, moist, brown.
(15'- 15.3') COBBLE.
(15.3'- 18.5') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~35% fines, ~15% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, moist to wet, brown, 3-inch cobble @ 17.5'.
(18.5'- 19') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine, ~25% gravel, fine to coarse, ~25% fines; max. size 2, slight naphthalene-like odor, wet, dark gray stained.
(19'- 20') SILTY SAND (SM); ~75% sand, fine to coarse, ~15% fines, ~10% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, wet, brown gray.
(20'- 21.5') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW); ~60% sand, fine to coarse, ~30% gravel, fine to coarse, ~10% fines; max. size 3, slight

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FT. = FEET

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PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
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GEI PROJECT NUMBER: 093080-1-1101

SSSB-20

ELEV. FT.	DEPTH FT.	TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
				0.0	NLO	SSSB-20 (23-24.5)
	25	S-5	5/1.8		NLO	
-10				0.0	NLO	SSSB-20 GRAB 3
				0.0	NLO	JHS = 4.5
	30	S-6	5/1.5	2.1		
-15					NLO	
				15.8		SSSB-20 GRAB 4 JHS = 150.2 SSSB-20 (33-34)
				0.7		
	35	S-7	5/1		NLO	
-20				0.2		
				4.2	NLO	JHS = 7.8
	40					

SOIL / BEDROCK DESCRIPTION

naphthalene-like odor, wet, gray brown.
(21.5'- 21.7') SANDY SILT (ML); ~60% fines, ~35% sand, fine, ~5% gravel, fine; slight naphthalene-like odor, wet, red brown.
(21.7'- 23.5') SANDY SILT (ML); ~65% fines, ~25% sand, fine to medium, ~10% gravel, fine to coarse; max. size 0.5, slight naphthalene-like odor, wet, brown gray.
(23.5'- 24.1') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~85% sand, fine, ~15% gravel, fine to coarse, ~10% fines; max. size 1, slight naphthalene-like odor, moist, brown, layer of blue-green fine to medium sand.
(24.1'- 25') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 0.5, slight naphthalene-like odor, dry, red brown to gray, 3-inch cobble @ 24.8'.
(25'- 26.9') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; max. size 1, slight naphthalene-like odor, wet, brown gray.
(26.9'- 27.8') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse; max. size 3, slight naphthalene-like odor, wet, gray.
(27.8'- 30') SILTY SAND (SM); ~75% sand, fine to medium, ~20% fines, ~5% gravel, fine to coarse; max. size 1, slight naphthalene-like odor, wet, brown gray, 1/4-inch layer of black soil @ 27.8'.
(30'- 30.5') COBBLE.
(30.5'- 33.7') SILT WITH SAND (ML); ~70% fines, ~20% sand, fine, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, brown.
(33.7'- 35') SILT WITH GRAVEL (ML); ~75% fines, non plastic, ~20% gravel, fine to coarse, ~5% sand, medium; max. size 2, wet, red brown.
(35'- 37.5') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, coarse, ~5% fines; max. size 2, slight naphthalene-like odor, wet, brown.
(37.5'- 40') NARROWLY GRADED SAND (SP); ~95% sand, medium to coarse, ~5% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, wet, brown.
End of Boring at 40 feet.
Tremie grout from bottom to top.

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CLIENT:	National Grid
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CITY/STATE:	Brooklyn, New York
GEI PROJECT NUMBER:	093080-1-1101

BORING LOG

SSSB-21

GROUND SURFACE ELEVATION (FT):	17.32
LOCATION:	Adjacent to and east of Holder 1
NORTHING (FT):	679779
EASTING (FT):	642571
TOTAL DEPTH (FT):	38.0
DRILLED BY:	William Shinn
DATUM VERT. / HORZ.:	NAVD 1988 / NAD 83
LOGGED BY:	Drew Blicharz
DATE START / END:	3/9/2016 - 3/9/2016
DRILLING DETAILS:	Sonic Coring / Small Roto Sonic
WATER LEVEL DEPTHS (FT):	
GENERAL NOTE:	

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	0		5/NM						CONCRETE.
15				NA				JHS = 0.9	(0.8'- 2') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~20% gravel, fine to coarse, ~5% fines; max. size 2, dry, brown, bricks, concrete, cobbles, hand cleared, FILL. (2'- 5') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, ~5% fines; max. size 2, dry to moist, brown dark brown, fewer bricks, concrete, cobbles, hand cleared, FILL.
	5	S-1	5/2.6	0.0					(5'- 7.9') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, ~5% fines; max. size 1, wet, brown, FILL.
10				0.1					
				0.0					(7.9'- 8.7') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; moist, light gray, FILL.
				0.0				JHS = 1.4 SSSB-21 GRAB 1	(8.7'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, ~5% fines; max. size 1, wet, brown, brick fragments, FILL.
	10	S-2	5/0.5						(10'- 15') NARROWLY GRADED SAND WITH GRAVEL (SP); ~50% sand, fine to medium, ~45% gravel, coarse, ~5% fines; wet, brown, 2.5-inch rock encapsulated by the sand, poor recovery, FILL.
5				0.0				JHS = 1.2	
				0.0					
	15	S-3	5/0.9	0.0					(15'- 20') NARROWLY GRADED SAND WITH GRAVEL (SP); ~75% sand, fine to medium, ~20% gravel, fine to coarse, ~5% fines; wet, brown, 2.5-inch rock at 15', poor recovery, FILL.
0				0.0				SSSB-21 GRAB 2	
	20	S-4	5/3.6	0.1			NLO	JHS = 1.4	(20'- 21.25') WIDELY GRADED SAND WITH SILT AND GRAVEL (SW-SM); ~65% sand, fine to coarse, ~25% gravel, fine to coarse, ~10% fines; max. size 3, slight naphthalene-like odor, wet, brown gray, FILL.
-5				0.1			NLO	SSSB-21 (21.5-22) JHS = 9.4	(21.25'- 21.8') WIDELY GRADED SAND WITH GRAVEL (SW); ~65% sand, fine to coarse, ~25% gravel, fine to coarse, ~5% fines; max. size 2, moderate naphthalene-like odor, wet, gray brown,
				0.4			NLO		
							NLO		

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CLIENT:	National Grid	BORING LOG	
PROJECT:	Skillman Street Holder Station	PAGE 2 of 2	SSSB-21
CITY/STATE:	Brooklyn, New York		
GEI PROJECT NUMBER:	093080-1-1101		

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
				0.4		
					NLO	SSSB-21 GRAB 3 JHS = 12.5
	25	S-5	5/0.7	0.8		
				0.5	NLO	
-10						
				0.7	NLO	
	30	S-6	5/3.8			
				4.1		JHS = 188
-15				9.6	NLO	
				3.3		
				0.9		
	35	S-7	3/1.3		NLO	
				0.3		SSSB-21 GRAB 4
-20				0.3		

SOIL / BEDROCK DESCRIPTION

FILL.
(21.8'- 23.5') SILTY SAND (SM); ~65% sand, fine to medium, ~25% fines, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, brown gray, brick fragments, FILL.
(23.5'- 24.2') SILTY SAND (SM); ~65% sand, fine to medium, ~25% fines, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, dark gray to black stained, FILL.
(24.2'- 25') SILTY SAND (SM); ~65% sand, fine to medium, ~25% fines, ~10% gravel, fine to coarse; max. size 1, moderate naphthalene-like odor, moist, brown gray, FILL.
(25'- 27.1') SILTY SAND (SM); ~80% sand, fine to coarse, ~15% fines, ~5% gravel, fine; max. size 0.25, moderate naphthalene-like odor, wet, brown gray, FILL.
(27.1'- 30') SILTY SAND (SM); ~70% sand, fine to coarse, ~15% gravel, fine to coarse, ~15% fines; max. size 0.5, moderate naphthalene-like odor, wet, brown gray, slight black staining, FILL.
(30'- 35') SILTY SAND (SM); ~55% sand, fine to medium, ~35% fines, ~10% gravel, fine to coarse; max. size 2, moderate naphthalene-like odor, wet, brown.
(35'- 36.3') WIDELY GRADED SAND WITH GRAVEL (SW); ~60% sand, fine to coarse, ~40% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, wet, brown.
(36.3'- 38') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, medium to coarse, ~20% gravel, fine to coarse; wet, gray.
End of Boring at 38 feet.
Tremie grout from bottom to top.

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CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-22

GROUND SURFACE ELEVATION (FT): 17.21
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679804 **EASTING (FT):** 642567
TOTAL DEPTH (FT): 40.0
DRILLED BY: William Shinn
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/10/2016 - 3/10/2016
DRILLING DETAILS: Sonic Coring / Small Roto Sonic
WATER LEVEL DEPTHS (FT):
GENERAL NOTE:

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID
	0		5/NM			
15						
	5	S-1	5/3	NA		
10				0.5		
				0.1		JHS = 2.9 SSSB-22 GRAB 1
	10	S-2	3/2.2	0.0		
				0.0		
5				0.0		
		S-3	1/1.7	0.1		JHS = 0.0
		S-4	1/1.5	0.1		
	15	S-5	5/3.6	0.1	NLO	
				0.1		
0				0.1	NLO	JHS = 0.9 SSSB-22 GRAB 2
				0.1		
				0.1	NLO	JHS = 0.4
	20	S-6	5/1.7			
				0.0		SSSB-22 (20-23)
-5					NLO	
				0.0	NLO	JHS = 0.3

SOIL / BEDROCK DESCRIPTION

(0'- 0.8') CONCRETE.

(0.8'- 2.5') SILTY SAND (SM); ~50% sand, fine to medium, ~40% fines, ~10% gravel, fine to coarse; max. size 2, dry, brown reddish brown, bricks, concrete, cobbles, hand cleared, FILL.
(2.5'- 5') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse; moist, reddish brown dark brown, coal fragments, hand cleared, FILL.

(5'- 8') SILTY SAND (SM); ~75% sand, fine to medium, ~20% fines, ~5% gravel, fine to coarse; max. size 1, wet, brown, FILL.

(8'- 8.5') SILTY SAND (SM); black stained, same as 5-8', FILL.
(8.5'- 10') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 1, wet, brown gray, FILL.
(10'- 13') SILTY SAND (SM); same as 8.5-10', max size 1.5-inches, FILL.

(13'- 13.5') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, coarse, ~5% fines; max. size 1, wet, brown gray, FILL.
(13.5'- 14') CONCRETE.
(14'- 15') WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine, ~5% fines; wet, brown gray, 3-inch cobble at 15', FILL.
(15'- 16.4') NARROWLY GRADED SAND WITH GRAVEL (SP); ~65% sand, fine to medium, ~30% gravel, fine to coarse, ~5% fines; max. size 2, wet, brown gray, a few 3-inch cobbles, FILL.
Slight naphthalene-like odor, 0.25-inch black stain @ 16', FILL.
(16.4'- 18.9') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to medium, ~35% gravel, fine to coarse, ~15% fines; max. size 2.5, slight naphthalene-like odor, moist, red brown and gray, brick at ~18', FILL.
(18.9'- 20') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine to medium, ~15% gravel, fine to coarse, ~15% fines; max. size 1, slight naphthalene-like odor,

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CLIENT: National Grid
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BORING LOG SSSB-22

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				0.0	NLO		moist, brown gray, brick fragments, FILL. (20'- 21') COBBLE; FILL.
	25	S-7	5/4.8	0.0			(21'- 23') NARROWLY GRADED SAND WITH GRAVEL (SP); ~55% sand, fine to medium, ~40% gravel, fine to coarse, ~5% fines; max. size 2.5, slight naphthalene-like odor, wet, gray, FILL.
-10				0.0			
				0.0	NLO	SSSB-22 GRAB 3	(23'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine, ~10% fines; slight naphthalene-like odor, wet, brown, FILL.
				0.0		JHS = 0.3	(25'- 27.5') SILTY SAND WITH GRAVEL (SM); ~65% sand, fine to coarse, ~20% gravel, fine to coarse, ~15% fines; max. size 2, wet, brown gray.
	30	S-8	5/3.1	0.0			(27.5'- 30') SILTY SAND WITH GRAVEL (SM); slight naphthalene-like odor, same as 25-27.5'.
-15						SSSB-22 GRAB 4	(30'- 31.8') SILTY SAND WITH GRAVEL (SM); ~60% sand, fine to coarse, ~25% gravel, fine to coarse, ~15% fines; max. size 2, wet, brown.
				0.0	NLO		(31.8'- 32.6') SILTY SAND (SM); ~75% sand, fine to coarse, ~15% fines, ~10% gravel, fine to coarse; max. size 2, wet, brown.
				0.0		JHS = 0.1	(32.6'- 35') SILTY SAND (SM); ~75% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; slight naphthalene-like odor, wet, brown to reddish gray, cobbles.
-20	35	S-9	5/0.5	0.0			(35'- 40') WIDELY GRADED GRAVEL (GW); ~100% gravel, fine to coarse; max. size 2, wet, gray, 7 rocks recovered.
	40						End of Boring at 40 feet. Tremie grout from bottom to top.

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC = RECOVERY LENGTH OF SAMPLE
PID = PHOTOIONIZATION DETECTOR READING (PPM)
JHS = JAR HEADSPACE PID READING (PPM)

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

GEI Consultants
GEI Consultants, Inc. P.C.
455 Winding Brook Drive
Suite 201
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-23

GROUND SURFACE ELEVATION (FT): 18.18
LOCATION: Adjacent to and east of Holder 1
NORTHING (FT): 679748 EASTING (FT): 642577
TOTAL DEPTH (FT): 45.0
DRILLED BY: Danny Ninevski
DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
LOGGED BY: Drew Blicharz
DATE START / END: 3/10/2016 - 3/11/2016
DRILLING DETAILS: Sonic Coring / Compact Roto Sonic
WATER LEVEL DEPTHS (FT): ▼ 17.00 3/11/2016 7:45 am
GENERAL NOTE: Temporary GW point, SSSB-23 (15-25), installed and sampled on 3/10/16

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
	0		5/NM						(0'- 0.8') CONCRETE.
15									(0.8'- 5') NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~65% sand, fine to medium, ~25% gravel, fine to coarse, ~10% fines; dry to moist, brown to red brown, bricks, concrete, cobbles, hand cleared, FILL.
	5	S-1	5/3.9	NA					(5'- 5.4') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; wet, dark gray, 3-inch chunk of metal, FILL.
				0.0					(5.4'- 6.4') SILT (ML); ~95% fines, non plastic, ~5% sand, fine; wet, gray to light brown, plastic fragments, FILL.
				0.0				SSSB-23 GRAB 1 JHS = 1.2	(6.4'- 7.3') SILT (ML); ~90% fines, non plastic, ~5% gravel, fine to coarse, ~5% sand, fine to medium; max. size 1, wet, light brown, FILL.
10				0.1					
				0.1					(7.3'- 10') SANDY SILT (ML); ~60% fines, ~30% sand, fine to medium, ~10% gravel, fine to coarse; max. size 1, moist, brown, FILL.
	10	S-2	5/4.2				NLO		(10'- 10.8') SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel, fine to coarse; max. size 1.5, slight naphthalene-like odor, moist, brown, slight chemical-like odor, FILL.
				0.1			NLO	SSSB-23 GRAB 5 SSSB-23 GRAB 2	(10.8'- 11.9') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, wet, brown to gray stained, FILL.
				0.1					
5				0.0			NLO		(11.9'- 14.5') SILTY SAND (SM); ~60% sand, fine to medium, ~30% fines, ~10% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, moist, dark brown, 2-inch red gravel @ 14', FILL.
				0.0					(14.5'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; dry, light gray, coarse rock at 15', FILL.
	15	S-3	5/4.2				NLO		(15'- 16') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine to medium, ~15% gravel, fine to coarse, ~15% fines; max. size 1.5, slight naphthalene-like odor, wet to moist, brown gray, FILL.
▼				0.1					(16'- 20') SILT WITH SAND (ML); ~70% fines, ~20% sand, fine, ~10% gravel; max. size 3, slight naphthalene-like odor, moist, red brown to gray, layer of gray widely graded sand with f-c gravel (25%) and 5 % fines @ 17.6 - 17.9', slight to moderate NLO, FILL.
				0.1					
0				1.7			NLO	JHS = 0.4	
				1.4					
	20	S-4	5/2						(20'- 24') SILT WITH SAND (ML); moderate
				0.7			NLO	JHS = 2.3	
-5				1.3					

NOTES:

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JHS = JAR HEADSPACE PID READING (PPM)

ppm = PARTS PER MILLION
IN. = INCHES
FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

NA = NOT APPLICABLE
NM = NOT MEASURED
Q_P = POCKET PENETROMETER
S_V = TORVANE PEAK

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CLIENT: National Grid
PROJECT: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1101

BORING LOG

SSSB-23

ELEV. FT.	DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN/REC FT./FT.	PID (PPM)	STRATA	VISUAL IMPACTS	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
				0.2					naphthalene-like odor, same as above, FILL. (24'- 25') CONCRETE; FILL.
	25	S-5	5/3.2	0.0 0.0			NLO	JHS = 0.0 SSSB-23 GRAB 3 SSSB-23 GRAB 6	(25'- 27.3') WIDELY GRADED GRAVEL WITH SAND (GW); ~60% gravel, fine to coarse, ~35% sand, fine to coarse, ~5% fines; max. size 1.5, slight naphthalene-like odor, wet, brown, loose, FILL.
-10				0.0 0.0			NLO		(27.3'- 30') SILTY SAND (SM); ~60% sand, fine to medium, ~20% gravel, fine to coarse, ~20% fines; max. size 1, slight naphthalene-like odor, dry, brown gray to dark gray, intermittent presence of dark red fine sand, brick fragments, FILL.
-15	30	S-6	5/4.9	0.0 0.0 2.0 7.1			NLO	SSSB-23 (32.5-33.5) JHS = 0.0 SSSB-23 GRAB 4 and GRAB 7	(30'- 34') SILTY SAND WITH GRAVEL (SM); ~50% sand, fine to medium, ~35% fines, ~15% gravel, fine to coarse; max. size 2, slight naphthalene-like odor, moist, brown gray, FILL.
				1.3			NLO		(34'- 35') SILTY SAND (SM); ~50% sand, fine to medium, ~15% fines, ~10% gravel, fine to coarse; max. size 1, slight naphthalene-like odor, moist, brown.
-20	35	S-7	5/0.8	0.0					(35'- 40') WIDELY GRADED GRAVEL (GW); ~95% gravel, fine to coarse, ~5% sand, fine to coarse; max. size 3, wet, gray.
	40	S-8	5/1.5	0.0					(40'- 42.7') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; max. size 1.5, wet, brown.
-25				0.0					(42.7'- 45') WIDELY GRADED GRAVEL WITH SAND (GW); ~80% gravel, fine to coarse, ~20% sand, fine to coarse; max. size 3, wet, brown.
	45								End of Boring at 45 feet. Tremie grout from bottom to top.

NOTES:

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JHS = JAR HEADSPACE PID READING (PPM)

NA = NOT APPLICABLE
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Q_P = POCKET PENETROMETER
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ppm = PARTS PER MILLION
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NLO = NAPHTHALENE LIKE ODOR
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TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
ALO = ASPHALT LIKE ODOR

CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

BORING INFORMATION

LOCATION: Adjacent to and east of Holder 1

GROUND SURFACE EL. (ft): 17.11 | **DATE START/END:** 3/10/2016 - 3/10/2016

VERTICAL DATUM: NAVD 88 | **DRILLING COMPANY:** Summit Drilling

TOTAL DEPTH (ft): 37.0 | **DRILLER NAME:** William Shinn

LOGGED BY: Drew Blicharz | **RIG TYPE:**

BORING SSSB-20

DRILLING INFORMATION

HAMMER TYPE: Automatic | **CASING I.D./O.D.:** NA/ 6.5 inch | **CORE BARREL TYPE:**

AUGER I.D/O.D.: NA / NA | **DRILL ROD O.D.:** NM | **CORE BARREL I.D./O.D.:** 3.5 inch / NA

DRILLING METHOD: Sonic Drilling

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation
= Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
						Hand cleared to 5 feet bgs. See environmental boring log.		
	5					Sonic soil sample collected 5-10 feet bgs. See environmental boring log.		
7	10					Sonic soil sample collected 10-15 feet bgs. See environmental boring log.		
	15					Sonic soil sample collected 15-20 feet bgs. See environmental boring log.		
						Sonic soil samples collected after split spoon samples 20-40 feet bgs. See environmental boring log.		
-3	20	S1	20 to 22	24/17	8-13-22-30	PID = 0.0, 0.0, 0.0		S1A (0-8"): NARROWLY GRADED SAND WITH GRAVEL (SP); ~55% f-m sand, ~40% f-c gravel up to 1", ~5% silt, brown-gray, wet. Slight naphthalene-like odor. S1B (8-14"): NARROWLY GRADED SAND WITH GRAVEL (SP); similar to S1A (0-8") with a 0.25" layer of white medium sand, reddish-gray. Slight naphthalene-like odor. S1C (14-16"): NARROWLY GRADED SAND WITH GRAVEL (SP); similar to S1A (0-8"), dark brown to gray. Slight

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

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Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Soil and Rock Description
							naphthalene-like odor.
	25	S2	25 to 27	24/8	9-11-16-24	PID = 0.0	S2A (0-3"): NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); ~75% f-m sand, ~15% fine gravel, ~10% silt, brown-gray, wet. Slight naphthalene-like odor. S2B (3-7"): WIDELY GRADED GRAVEL (GW); ~90% f-c gravel up to 1", ~5% f sand, ~5% silt, red, wet. S2C (7-8"): NARROWLY GRADED SAND (SP); ~95% f-m sand, ~5% silt, dark gray to gray, wet. Slight naphthalene-like odor.
-13	30	S3	30 to 30.2	2/0	50/2		S3: NO RECOVERY.
	35	S4	35 to 37	24/3	20-24-21-24	PID = 0.0, 0.0	S4 (0-3"): WIDELY GRADED GRAVEL (GW); ~100% f-c gravel up to 1", gray, wet.
							Bottom of boring at depth of ~37.0' below grade - planned extent of borehole. Summit tremie-grouted the hole upon completion of the boring.
-23	40						
	45						
-33	50						
	55						

NOTES:

BORING INFORMATION

LOCATION: Adjacent to and east of Holder 1

GROUND SURFACE EL. (ft): 17.32 **DATE START/END:** 3/9/2016 - 3/9/2016

VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

TOTAL DEPTH (ft): 35.2 **DRILLER NAME:** William Shinn

LOGGED BY: Drew Blicharz **RIG TYPE:**

BORING SSSB-21

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ 6.5 inch **CORE BARREL TYPE:**

AUGER I.D/O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 3.5 inch / NA

DRILLING METHOD: Sonic Drilling

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	0					Hand cleared to 5 feet bgs. See environmental boring log.		
	5					Sonic soil sample collected 5-10 feet bgs. See environmental boring log.		
7	10	S1	10 to 12	24/8	3-4-3-3	PID = 0.0, 0.0		S1: NARROWLY GRADED SAND (SP); ~95% f-m sand, ~5% silt, brown, wet, FILL.
						Sonic soil samples collected after split spoon samples 10-38 feet bgs. See environmental boring log.		
	15	S2	15 to 17	24/9	7-13-11-4	PID = 0.0, 0.0		S2A (0-2"): WIDELY GRADED GRAVEL WITH SAND (GW); ~85% f-c gravel up to 0.75", ~15% sand, red, wet, FILL. S2B (2-9"): NARROWLY GRADED SAND (SP); ~85% f-m sand, ~10% f-c gravel up to 1", ~5% fines, brown, wet, FILL.
-3	20	S3	20 to 21.9	23/14	8-7-8-50/5	PID = 0.0, 0.0		S3A (0-3"): WIDELY GRADED SAND WITH GRAVEL (SW); ~75% f-c sand, ~20% f-c gravel up to 0.5", ~5% silt, brown-gray, wet, FILL. Slight petroleum-like odor. S3B (3-8"): WIDELY GRADED GRAVEL WITH SAND (GW); ~65% f-c gravel up to 1", ~30% f-c sand,~5% silt, red and brown, wet, FILL. S3C (8-14"): WIDELY GRADED SAND WITH GRAVEL (SW); ~90% f-c sand, ~5% fine gravel, ~5% silt, brown, wet, FILL.

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

LOCATION: Adjacent to and east of Holder 1
GROUND SURFACE EL. (ft): 17.32 **DATE START/END:** 3/9/2016 - 3/9/2016
VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

BORING SSSB-21

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Soil and Rock Description
	25	S4	25 to 27	24/16	8-14-17-29	PID = 0.6, 0.6, 1.0	S4A (0-11"): NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% f-m sand, ~10% silt, ~5% f-c gravel up to 0.5", brown-gray, moist to wet. A 1" black stained layer 0.7'. Slight naphthalene-like odor. S4B (11-16"): NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% f-m sand, ~10% f-c gravel up to 0.5", ~10% silt, brown to brown-gray, moist to wet. Slight naphthalene-like odor.
-13	30	S5	30 to 32	24/16	8-16-19-30	PID = 2.0, 1.0, 9.2	S5: SILTY SAND WITH GRAVEL (SM); ~65% f-m sand, ~20% f-c gravel up to 1", ~15% silt, brown, wet. Moderate naphthalene-like odor.
	35	S6	35 to 35.2	2/0	50/2		S6: NO RECOVERY. Bottom of boring at depth of ~35.2' below grade where refused. Summit tremie-grouted the hole upon completion of the boring.
-23	40						
	45						
-33	50						
	55						

NOTES:

PROJECT NAME: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

BORING INFORMATION

LOCATION: Adjacent to and east of Holder 1

GROUND SURFACE EL. (ft): 17.21 **DATE START/END:** 3/10/2016 - 3/10/2016

VERTICAL DATUM: NAVD 88 **DRILLING COMPANY:** Summit Drilling

TOTAL DEPTH (ft): 40.0 **DRILLER NAME:** William Shinn

LOGGED BY: Drew Blicharz **RIG TYPE:**

BORING SSSB-22

DRILLING INFORMATION

HAMMER TYPE: Automatic **CASING I.D./O.D.:** NA/ 6.5 inch **CORE BARREL TYPE:**

AUGER I.D/O.D.: NA / NA **DRILL ROD O.D.:** NM **CORE BARREL I.D./O.D.:** 3.5 inch / NA

DRILLING METHOD: Sonic Drilling

WATER LEVEL DEPTHS (ft): Not measured

ABBREVIATIONS:
Pen. = Penetration Length
Rec. = Recovery Length
RQD = Rock Quality Designation = Length of Sound Cores>4 in / Pen.,%
WOR = Weight of Rods
WOH = Weight of Hammer
S = Split Spoon Sample
C = Core Sample
U = Undisturbed Sample
SC = Sonic Core
DP = Direct Push Sample
HSA = Hollow-Stem Auger
Qp = Pocket Penetrometer Strength
Sv = Pocket Torvane Shear Strength
LL = Liquid Limit
PI = Plasticity Index
PID = Photoionization Detector
I.D./O.D. = Inside Diameter/Outside Diameter
NA, NM = Not Applicable, Not Measured
Blows per 6 in.: 140 lb hammer falling 30 inches to drive a 2-inch-O.D. split spoon sampler.

Elev. (ft)	Depth (ft)	Sample No.	Sample Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	0					Hand cleared to 5 feet bgs. See environmental boring log.		
	5					Sonic soil sample collected 5-10 feet bgs. See environmental boring log.		
7	10					Sonic soil sample collected 10-15 feet bgs. See environmental boring log.		
	15					Sonic soil sample collected 15-20 feet bgs. See environmental boring log.		
						Sonic soil samples collected after split spoon samples 20-40 feet bgs. See environmental boring log.		
-3	20	S1	20 to 20.9	11/1	18-50/5	PID = 0.1		S1: NARROWLY GRADED SAND (SP); ~95% f-m sand, ~5% silt, brown, wet.

NOTES:

PROJECT NAME: Skillman Street Holder Station

CITY/STATE: Brooklyn, New York

GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

LOCATION: Adjacent to and east of Holder 1
GROUND SURFACE EL. (ft): 17.21
VERTICAL DATUM: NAVD 88
DATE START/END: 3/10/2016 - 3/10/2016
DRILLING COMPANY: Summit Drilling

Elev. (ft)	Depth (ft)	Sample Information: Sample No.	Depth (ft)	Pen./ Rec. (in)	Blows per 6 in. or RQD	Drilling Remarks/ Field Test Data	Graphic Log	Soil and Rock Description
	25	S2	25 to 27	24/12	11-11-15-23	PID = 0.0, 0.0		S2: SILTY SAND (SM); ~80% f-m sand, ~15% silt, ~5% f-c gravel up to 1.5", brown to reddish-brown, wet.
-13	30	S3	30 to 31.4	17/5	13-11-50/5	PID = 0.0		S3: WIDELY GRADED SAND WITH GRAVEL (SW); ~75% f-c sand, ~20% f-c gravel up to 1", ~5% silt, brown-gray, wet.
	35	S4	35 to 37	24/5	10-10-9-22	PID = 0.0		S4: WIDELY GRADED SAND (SW); ~85% f-c sand, ~10% f-c gravel up to 1", ~5% silt, dark gray, wet.
-23	40	S5	40 to 40	0/0	REF			Bottom of boring at depth of ~40.0' below grade where refused. Summit tremie-grouted the hole upon completion of the boring.
	45							
-33	50							
	55							

NOTES:

PROJECT NAME: Skillman Street Holder Station
CITY/STATE: Brooklyn, New York
GEI PROJECT NUMBER: 093080-1-1107

GEI Consultants

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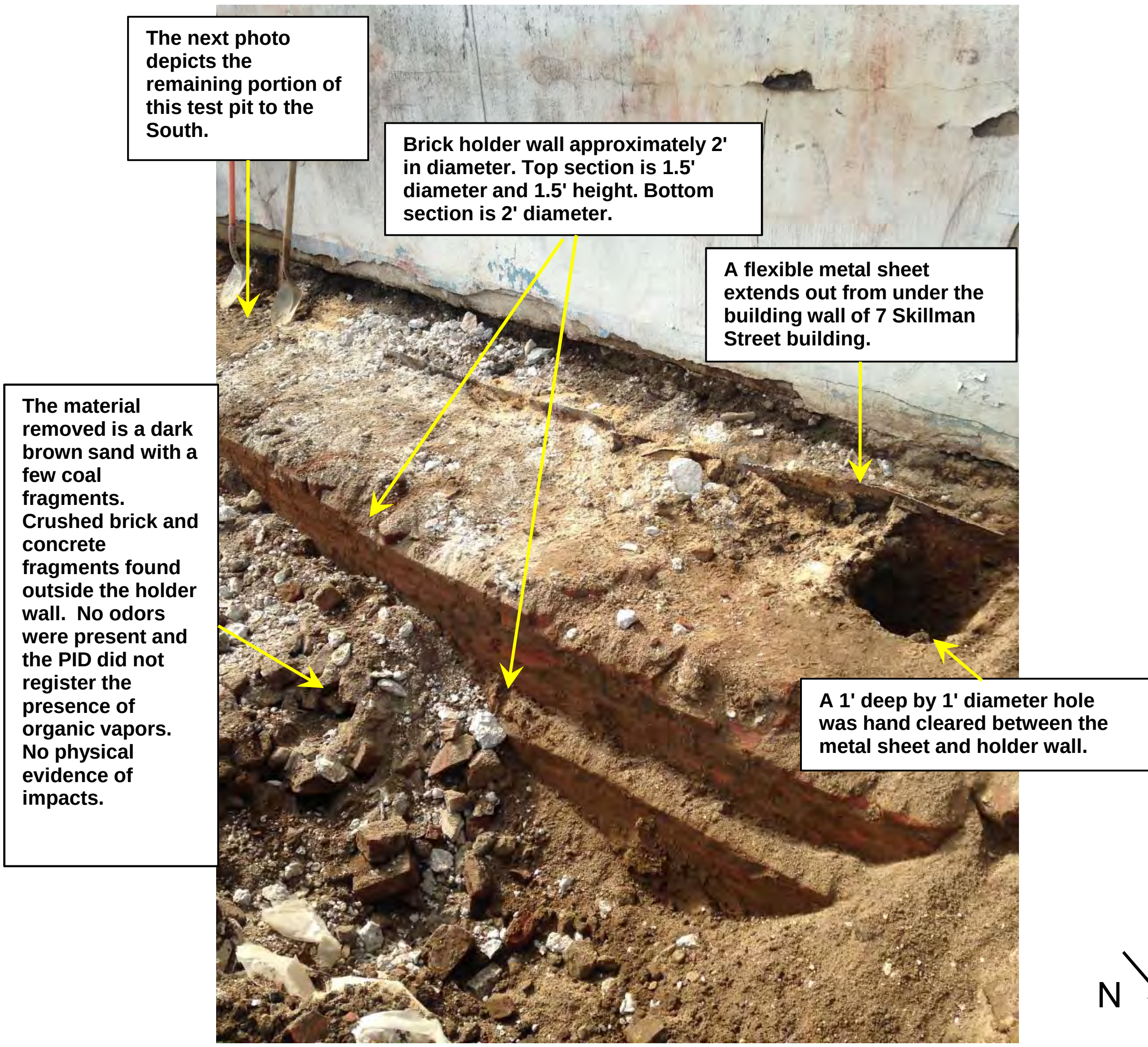
455 Winding Brook Drive
Glastonbury, CT 06033
(860) 368-5300

CLIENT:	National Grid	TEST PIT LOG	
PROJECT:	Former Skillman Street Holder Station Site	PAGE 1 of 2	SSTP-01
CITY/ST:	Brooklyn, New York		
GEI PROJECT #:	093080-1-1107		

NORTHING: 679793.21	EASTING: 642565.83	LOCATION: Southeast side of northeastern Holder No. 1
NORTHING: 679770.98	EASTING: 642569.37	TOTAL DEPTH: ~ 5 ft
OBSERVED BY: Jonathan Tamargo		TOTAL LENGTH: ~ 20 ft
OPERATOR: Carlos Contreras (Island Pump and Tank)		TOTAL WIDTH: ~ 8 ft
EQUIPMENT: CAT 420 rubber-tired backhoe		DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
WEATHER: 60s, clear, dry		DATE START / END: 03/08/2016 - 03/08/2016

Photograph 1: Facing Southwest

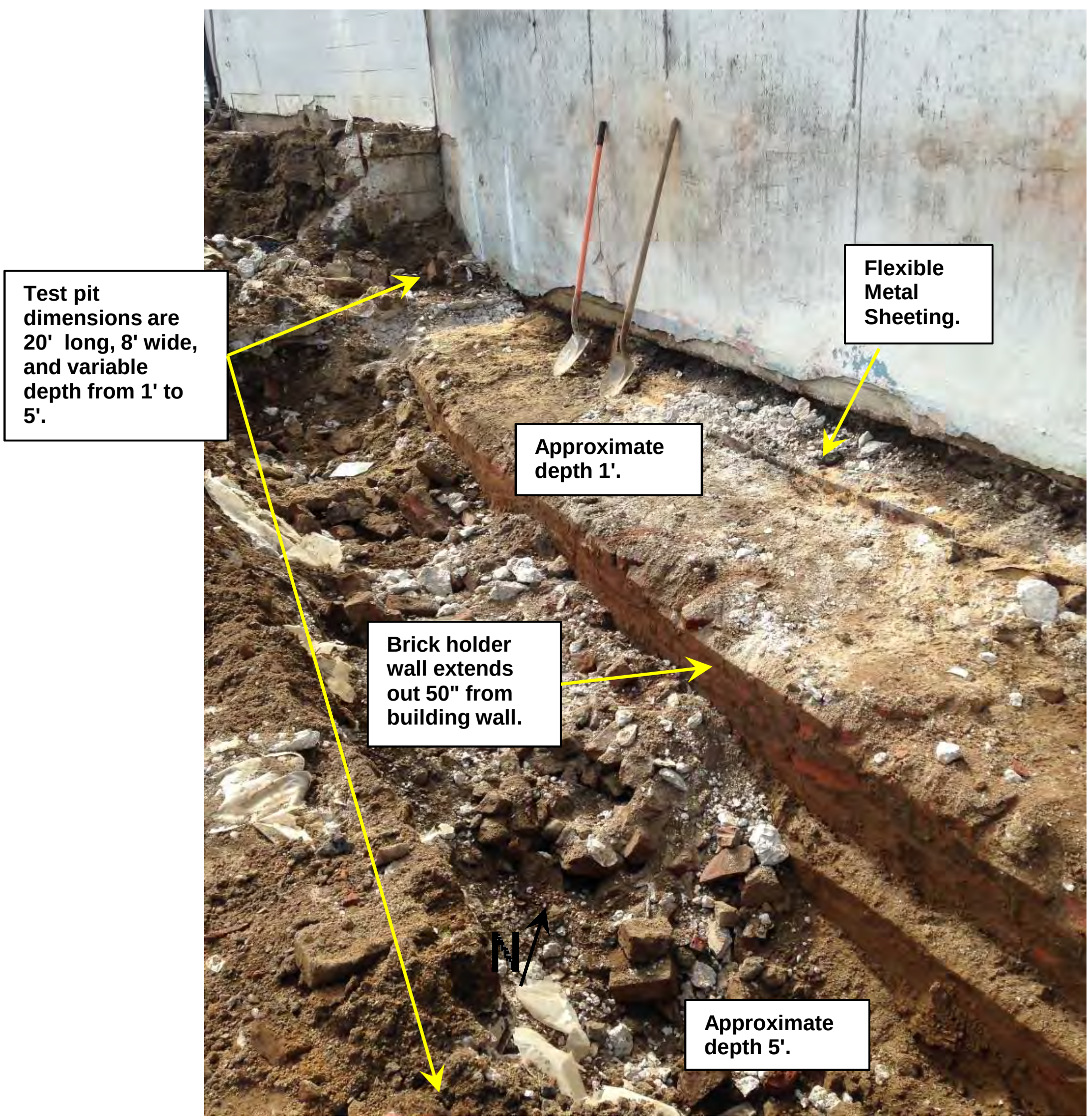


N

GEI Consultants	GEI Consultants, Inc., P.C. 455 Winding Brook Drive Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Former Skillman Street Holder Station Site CITY/ST: Brooklyn, New York GEI PROJECT #: 093080-1-1107	TEST PIT LOG PAGE 2 of 2 SSTP-01

NORTHING: 679793.21 EASTING: 642565.83	LOCATION: Southeast side of northeastern Holder No. 1
NORTHING: 679770.98 EASTING: 642569.37	TOTAL DEPTH: ~ 5 ft
OBSERVED BY: Jonathan Tamargo	TOTAL LENGTH: ~ 20 ft
OPERATOR: Carlos Contreras (Island Pump and Tank)	TOTAL WIDTH: ~ 8 ft
EQUIPMENT: CAT 420 rubber-tired backhoe	DATUM VERT. / HORZ.: NAVD 1988 / NAD 83
WEATHER: 60s, clear, dry	DATE START / END: 03/08/2016 - 03/08/2016

Photograph 2: Facing South



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Appendix F

Health and Safety Plan (Electronic Only)

GEI Consultants

Consulting
Engineers and
Scientists

Health and Safety Plan

Skillman Street Former Holder Station
7 Skillman Street & 744 Bedford Avenue
Brooklyn, New York

Prepared For:
National Grid NY
One MetroTech Center
Brooklyn, NY 11201

Submitted by:
GEI Consultants, Inc., P.C.
455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033
860.368.5311

January 2017

Project No. 093080-1-1106

Melissa Felter
Project Manager

Steven Hawkins, CSP
Regional Health and Safety Officer

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D. Forms
E. GEI Health and Safety SOPs
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1. Emergency Contact Information

Table 1. Emergency Information

Important Phone Numbers		Directions to Hospital
Local Police:	911	To Hospital and Occupational Health Clinic: See Attached Maps and Directions in Appendix A
Fire Department:	911	
Ambulance:	911	
State Police or County Sheriff:	911	
Local Hospital: The Brooklyn Hospital Center 121 DeKalb Avenue Brooklyn, NY 11201	(781) 250-8075	
Local Occupational Health Clinic: Beth Israel Medical Center/BHSN Occupational Medicine Clinic 317 E. 17th Street, Bldg 281 New York, NY 10003	(212) 420-2000	
Project Manager: Melissa Felter	(860) 368-5328 office (860) 608-9717 cell	
Corporate Health and Safety Officer : Robin B. DeHate, Ph.D.	(813) 774-6564 office (813) 323-6220 cell	
Regional Health and Safety Officer Steve Hawkins, CSP	(860) 368-5348 office (860) 916-4167 cell	
Client Contact: Donald Campbell - National Grid	(718) 963-5453 office (347) 452-5973 cell	
Nearest Telephone Location: On-site cellular		

2. Background Information

2.1 General

Engineer	GEI Consultants, Inc. (GEI) 455 Winding Brook Drive, Suite 201 Glastonbury, CT 06033
Project Name	Skillman Street Former Holder Station 7 Skillman Street & 744 Bedford Avenue Brooklyn, NY 11205

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the Skillman Street Former Holder Station, 7 Skillman Street and 744 Bedford Avenue in Brooklyn, New York. GEI personnel and Subcontractors are required to review and sign this HASP, acknowledging that they understand and will adhere to this HASP. Subcontractors will also prepare their own Site-specific HASP for the protection of their employees from the hazards associated with their work tasks and may use this document as a guide. GEI will verify that its subcontractor's HASP includes National Grid site-specific requirements, as outlined in this HASP.

Additionally, federal, state and local representatives, as well as National Grid employees may be required to sign and adhere to this HASP, depending on the nature of their presence onsite during activities conducted by GEI. The plan identifies measures to minimize accidents and injuries, which may result from project activities or during adverse weather conditions. A copy of this HASP will be maintained on site for the duration of the work.

Included in Section 1 and Appendix A is a route to the nearest medical facility from the Site with directions and contact information. Safety data sheets (formerly known as Material Safety Data Sheets [MSDS]) specific to chemicals that may be encountered while working at the Site, are in Appendix B. Appendix C details the signs, symptoms, care and procedures to both heat and cold stress. Appendix D includes the Tailgate Safety Briefing form, the Project Safety Briefing form, the Accident/Incident Report Form and the Near Miss Reporting Form. Appendix E contains the GEI Health and Safety (H&S) Standard Operating Procedures (SOPs) that apply to this project. Appendix F contains Emergency Event Procedures for GEI Personnel.

GEI and Subcontractor employees have the authority to stop work activities if an unanticipated hazard is encountered or a potential unsafe condition is observed. The GEI employee should contact the Corporate Health and Safety Officer and the Project Manager to discuss the stop work conditions and potential control methods that can be implemented.

2.2 Project Description

This Site Management Plan (SMP) is required as an element of the remedial program at the Skillman Street Former Holder Station site under the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program administered by New York State Department of Environmental Conservation (NYSDEC). National Grid entered into an Administrative Order on Consent (AOC) Index # A2-0552-0606, Site # 224068, to investigate the ¾-acre property located in Brooklyn, Kings County, New York on February 7, 2007. This AOC required the Remedial Party, National Grid, to investigate Manufactured Gas Plant (MGP)-related residuals at the Site. In accordance with the AOC, a Site Characterization (SC) was performed on the Site from August of 2010 to June of 2013 and an SC Report was written and submitted in March of 2014.

Potential MGP residual impacts were found on the Site during the SC; however, exposure to these impacts is currently limited by existing buildings across the entirety of the Site. The SC Report was accepted by the NYSDEC in consultation with the New York State Department of Health (NYSDOH) on November 7, 2014. Following approval of the report, GEI was instructed to develop and submit a Site Management Plan (SMP) prior to the start of any potential redevelopment of the Site, including an example Health and Safety Plan (HASP). The SMP was prepared to manage MGP residual impacts during groundwater sampling, potential soil vapor intrusion sampling, and potential intrusive activities at the Site and this HASP was written to serve as a general template for GEI's observation of to-be-determined intrusive activities.

2.3 Site Description

The site is located in the Bedford-Stuyvesant neighborhood of Brooklyn, Kings County, New York and is identified as 2 lots, currently owned by 2 separate entities, with Block and Lot Numbers on the City of New York Tax Map as shown in the following Table:

Table 2: Site Property Divisions and Owners

Owner	Bedford-Flushing Holding Corp. 16 East 34th Street New York, NY 10016	Bedford Roth Holding, LLC 760 Bedford Avenue Brooklyn, NY 11205
Occupant	Eden Palace, Inc. Ballroom/Banquet Facility	Concord Plaza, Inc. Banquet Facility
Block and Lot Number	Block 1886 Lot 19	Block 1886 Lot 145
Property Address	7 Skillman Street Brooklyn, NY 11205	744 Bedford Avenue Brooklyn, NY 11205
Current Zoning	M1-2/R6A	M1-2/R6A

The site is an approximately 3/4-acre area bounded by the property boundary of 7 Skillman Street. The 744 Bedford Avenue parcel is included as part of the Site because the 7 Skillman Street parcel formerly included a 10-foot wide portion of this parcel.

3. Statement of Safety and Health Policy

GEI is committed to providing a safe and healthy work environment for its employees. To maintain a safe work environment, GEI has established an organizational structure and a Corporate Health and Safety Program to promote the following objectives:

- Reduce the risk of injury, illness, and loss of life to GEI employees.
- Maintain compliance with federal, state, and other applicable safety regulations; and minimize GEI employees' work exposure to potential physical, chemical, biological, and radiological hazards.

Safety policy and procedure on any one project cannot be administered, implemented, monitored, and enforced by any one individual. The total objective of a safe, accident free work environment can only be accomplished by a dedicated, concerted effort by every individual involved with the project from management down to all employees.

Each GEI employee must understand their value to the company; the costs of accidents, both monetary, physical, and emotional; the objective of the safety policy and procedures; the safety rules that apply to the safety policy and procedures; and what their individual role is in administering, implementing, monitoring, and compliance of their safety policy and procedures. This allows for a more personal approach to compliance through planning, training, understanding, and cooperative effort, rather than by strict enforcement. If for any reason an unsafe act persists, strict enforcement will be implemented.

4. Hazard/Risk Analysis

Physical hazards associated with heavy equipment, excavation, and demolition operations will likely be present during potential redevelopment activities. The heavy equipment associated with this project and general redevelopment of this site will include demolition, excavation, and material removal equipment. Some of the hazards associated with this equipment include crushing of limbs, slipping, tripping, or falling, and heavy lifting.

Chemical hazards present in the subsurface of the Site may include volatile organic compounds (VOCs), coal tar and coal tar products, asbestos, cyanide, and hydrogen sulfide. These chemical hazards are discussed in Section 4.3.

The Contractor should verify that electric, gas, water, steam, sewer, and other service lines are shut off, capped, or otherwise controlled, at or outside the building before demolition work is started. In each case, any utility company that is involved should be notified in advance by the Contractor, and its approval or services, if necessary, will be obtained.

Smoking is prohibited at or in the vicinity of hazardous operations or materials. Where smoking is permitted, safe receptacles will be provided for smoking materials. The hazards for this operation are listed in the following Activity Hazard Analysis and Site Hazards sections.

4.1 Personal Safety

Field activities have the potential to take employees into areas which may pose a risk to personal safety. The following websites (sources) have been researched to identify potential crime activity in the area of the project:

- www.crimereports.com: One assault was identified in the past 30 days within a mile of the Site.
- www.cityrating.com/crimestatistics.asp: In 2012 the city violent crime rate in New York was higher than the violent crime rate in New York by 57.15% and the city property crime rate in New York was lower than the property crime rate in New York by 10.4%.
- www.crimemapping.com: No crimes identified in the past 30 days within a mile of the Site.

To protect yourself, take the following precautions:

- If deemed necessary by the PM, use the buddy system (teams of a minimum of two persons present);
- Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave;
- Call in regularly;
- Pay attention to what is going on around you; and
- If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.

Employees must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If employees encounter hostile individuals or a confrontation develops in the work area, suspend work activities, immediately leave the area of concern, and contact local 911 for assistance. Notify the SSO and Corporate Health and Safety Officer (CHSO) of any incidents once you are out of potential danger.

In the event of an emergency, prompt communications with local emergency responders is essential. At least one charged and otherwise functioning cell phone to facilitate emergency communications will be on-site. Confirmation of cellular phone operation will be confirmed at the start of each working day.

4.2 Activity Hazard Analysis

The potential hazards for this project associated with site conditions and activity hazards associated with GEI on-site activities have been identified in Table 3. General hazards and control measures that are applicable to all site activities are identified in the General Hazards section. The site-specific tasks, potential hazards, and control measures established to reduce the risk of injury or illness are identified in the Activity Hazard section of Table 3. Health and Safety SOPs for routine hazards and common site conditions are referenced in the table below and included in Appendix E.

Table 3. Activity Hazard Analysis

General Hazards These Hazards Apply to All Site Activities	**Control Measure**
Chemical / Contaminant Exposure – Skin and eye injury/irritation	• Wear protective coveralls (e.g. Tyvek ®) with shoe covers, safety glasses, face shield, Nitrile gloves. • Dispose of gloves after use and wash hands. • Avoid contact with pooled liquids and limit contact with contaminated soils/groundwater. • See SOP HS-009
Cold Stress – Hypothermia, Frostbite	• Take breaks in heated shelters when working in extremely cold temperatures. • Drink warm liquids to reduce the susceptibility to cold stress. • Wear protective clothing (recommended three layers: an outside layer to break the wind, a middle layer to provide insulation, and an inner layer of cotton of synthetic weave to allow ventilation). • Wear a hat and insulated boots. • Keep a change of dry clothing available in case clothes become wet. • Do heavy work during the warmer parts of the day and take breaks from the cold. • If possible shield work areas from drafts of wind and use insulating material on equipment handles when temperatures are below 30°F • Watch for symptoms of cold stress. (see Appendix C in HASP)
Driving	• Employees must wear their safety belt while in a moving vehicle. • Vehicle accidents will be reported in accordance with GEI's accident reporting procedures. • Vehicles will be properly maintained and safely operated (refer to GEI's Fleet Maintenance Program). • Employees will follow safe driving behaviors, which include limiting distractions such as manipulating radios or other equipment that may cause a distraction. Employees should not exceed the posted speed limit and should maintain a safe distance between other vehicles. • Use defensive driving techniques. • Driving distance and time after a 12-hour shift should not exceed 30 miles or 30 minutes (whichever is greater). • See SOP HS-004

General Hazards These Hazards Apply to All Site Activities	Control Measure
Heat stress – Fainting, Fatigue, Heat Stroke	• Increase water intake while working. • Increase number of rest breaks and/or rotate workers in shorter work shifts. Rest in cool, dry areas. • Watch for signs and symptoms of heat exhaustion and fatigue. • Plan work for early morning or evening during hot months. • Use ice vests when necessary. • In the event of heat stroke, bring the victim to a cool environment and initiate first aid procedures. • See Appendix C of the HASP
Inclement Weather	• Listen to local forecasts for warnings about specific weather hazards such as tornados, thunder storms, and flash floods. • If the storms produce thunder and/or lightning, leave the work area immediately and move to a safe area. • Discuss an action plan prior to the severe weather. • Wear appropriate PPE for the type of weather that could be encountered. • Stop work until conditions are suitable. Take cover in vehicles or shelter as appropriate. • See SOP HS-010
Physical Injury – Slips, Trips and Falls	• Wear PPE that properly fits, is in good condition and appropriate for the activities and hazards. • Maintain good visibility of the work area. • Avoid walking on uneven, steeply sloped or debris ridden ground surfaces. • Plan tasks prior to preforming them including an activity hazard analysis. • Keep trafficked areas free from slip/trip/fall hazards. • Maintain weed growth in sampling areas, especially on slopes. • Wear shoes with traction. • Avoid traversing steep areas in slippery conditions. • Do not carry heavy objects to sampling areas, on steeply sloped areas, or where steep areas must be traversed to arrive at sample points.
Repetitive Motion Injury - Standing, Squatting, and Bending Over	• Take regular breaks and do not work in unusual positions for long periods of time. • Walk and stretch between tasks. • See SOP HS-025

General Hazards **These Hazards Apply to All Site Activities**	**Control Measure**
Unsecured or High Crime Areas	• Be aware of your surroundings. • Use the buddy system. Do not remain on site alone. Accompany or be accompanied by others to vehicles. • Request police detail when appropriate. • Let the Site Safety Officer (SSO) know when you begin work in these areas and when you leave. • Call in regularly. • If you arrive in an area and it does not look safe to get out of your vehicle, lock the doors and drive off quickly but safely.
Utilities – Shock, Electrocution, Fire, Explosion	• A thorough underground utility survey must be conducted prior to intrusive activities. Coordination with utility locating services, property owner(s) or utility companies must be conducted. • Utilities are to be considered live or active until documented otherwise. • For overhead utilities within 50 feet, determine with the utility company the appropriate distance. Minimum distance for clearance is based on voltage of the line. • If exposing a utility, proper support and protection must be provided so that the utility will not be damaged. • If a gas line is contacted, the contractor must notify police, fire, and emergency personnel, and evacuate employees according to the site evacuation procedures. No attempt should be made to tamper with or correct the damaged utility. • See SOP HS-014
Vehicular Traffic – Struck by injury, crushing	• Increase visibility of the work area to others by using cones, flags, barricades, proper lighting and caution tape to define work area. • Use a "spotter" to locate oncoming vehicles. • Use vehicle to block work area. • Engage police detail for all work conducted in appropriate areas. • Wear high-visibility, reflective vest at all times. • Maintain minimum DOT defined distances to other traffic lanes. • See SOP HS-016.

Activity	Potential Hazard	Control Measures
Asbestos Exposure	Respiratory irritation, eye irritation, skin irritation	• APR with P-100 cartridges, Steel-toe/shank boots, gloves, protective clothing, negative pressure air machines with HEPA filters and exterior exhaust
Construction Site Entry	Struck-by, caught-in-between equipment, crushing, pinch points	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or (electrical hazard) EH-rated safety boots with composite toe and shank; safety glasses; nitrile/neoprene gloves; and earplugs. • Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. • Coordinate hand signals with operators. • Stay Alert! Pay attention to equipment backup alarms and swing radii. • Wear a high-visibility, reflective vest when working near equipment or motor vehicle traffic. • Position yourself in a safe location when filling out logs talking with the contractor. • Notify the contractor immediately if any problems arise. • Do not stand or sit under suspended loads or near any pressurized equipment lines. • Do not operate cellular telephones in the vicinity of heavy equipment operation. • See HS-018
Decontamination of equipment and PPE	Possible exposure to decontamination chemicals	• Wear rubber gloves, and glasses to provide eye protection from splashing. Wash hands immediately after use.
Drilling Oversight/ Sampling	Contaminant Exposure, Noise, Contact with Utilities, Cuts/Scrapes, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses; Nitrile/neoprene gloves; and earplugs. • Confirm utility locate has been completed. • Confirm adequate clearance from overhead utilities. • Dispose of gloves after use and wash hands. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
Drilling (Indoors)	Contaminant Exposure, Noise, Contact with Utilities, Cuts/Scrapes, Heavy Lifting, Repetition, Slips/Trips/Fall	• Wear protective gear including safety glasses • Be aware of your surroundings • Ensure that general public has adequate barrier between or distance from drill rig. • Ensure adequate ventilation and dust control methods are implemented. • Conduct air monitoring for carbon monoxide gas while conducting drilling activities.

Activity	Potential Hazard	Control Measures
Drum Handling	Contaminant Contact Cuts or Abrasions Heavy Lifting , Slips/Trips/Falls	• Wear proper PPE during sampling including nitrile gloves and safety glasses and face shield as appropriate. • Use proper dollies or drum moving tools. • Use applicable tools to open/close drum lids. • Do not handle drums with bulging sides. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Use proper lifting techniques. • Ask fellow worker for help. • Keep trafficked areas free from slip/trip/fall hazards. • See SOP HS-003
Excavation and Trenching Oversight	Crushing, entrapment, falls, fire/explosion	• Prior to excavating, determine utility locations and have locations marked by utility companies and the property owner. • Utilities shall be properly supported and barriers should be erected around excavations in remote areas. • Backfill temporary excavations when work is completed. • Personnel must remain 2 feet from the face of the excavation. • Sides, slopes, and faces shall meet OSHA requirements. • Excavation entry will be allowed only with proper sloping or shoring. • See SOP HS-006
Groundwater Sampling	Contaminant Exposure, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses and Nitrile/neoprene gloves. • Dispose of gloves after use and wash hands. • User proper lifting techniques. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
Heavy Lifting	Back injury, knee injury	• Use proper lifting techniques. • Ask fellow worker for help. • Use a mechanical lifting device or a lifting aid where appropriate. • If you must lift, plan the lift before doing it. • Check your route for clearance. • Bend at the knees and use leg muscles when lifting. • Use the buddy system when lifting heavy or awkward objects. • Do not twist your body while lifting. • See SOP HS-025

Activity	Potential Hazard	Control Measures
Heavy Equipment – Working Near	Struck-by, caught-in-between equipment, crushing, pinch points	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or (electrical hazard) EH-rated safety boots with composite toe and shank; safety glasses; nitrile/neoprene gloves; and earplugs. • Identify yourself and your work location to heavy equipment operators, so they may incorporate you into their operations. • Coordinate hand signals with operators. • Stay Alert! Pay attention to equipment backup alarms and swing radii. • Wear a high-visibility, reflective vest when working near equipment or motor vehicle traffic. • Position yourself in a safe location when filling out logs talking with the contractor. • Notify the contractor immediately if any problems arise. • Do not stand or sit under suspended loads or near any pressurized equipment lines. • Do not operate cellular telephones in the vicinity of heavy equipment operation. • See SOP HS-018
Soil Sampling/Soil Vapor Sampling	Contaminant Exposure, Cuts/Scrapes, Heavy Lifting, Repetition, Slips/Trips/Falls	• Wear hardhat; high visibility reflective safety vest; steel-toed, steel-shank boots or composite toe and shank; safety glasses; Nitrile/neoprene gloves; and earplugs as necessary. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Excavation entry will be allowed only with proper sloping or shoring. • Take regular breaks and do not work in unusual positions for long periods of time. • Keep trafficked areas free from slip/trip/fall hazards.
Waste Characterization	Contaminant Contact Cuts or Abrasions, Slips/Trips/Falls	• Wear proper PPE during sampling including nitrile gloves and safety glasses. • Dispose of gloves after use and wash hands. • Wear work gloves over nitrile gloves. • Keep trafficked areas free from slip/trip/fall hazards.

Personal Protective Equipment (PPE) is the initial level of protection based on the activity hazards and Site conditions which have been identified. Upgrades to respiratory protection may be required based on the designated Action Levels found in Section 9. General on-site provisions will include: extra nitrile, leather, and/or Kevlar gloves, extra protective coveralls (e.g. Tyvek®) with boot covers, drinking water and electrolyte fluids, reflective vest, first aid kit, fire extinguisher, hearing protection, and washing facilities.

If Site conditions suggest the existence of a situation more hazardous than anticipated, the Site personnel will evacuate the immediate area. The hazard, the level of precautions, and the PPE will then be reevaluated with the assistance and approval of the CHSO (Robin DeHate) and the Project Manager (PM) Melissa Felter.

4.2.1 Handling Drums and Containers

Regulations for handling drums and containers are specified by Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120(j). Potential hazards associated with handling drums include vapor generation, fire, explosions, and possible physical injury. Handling of drums/containers during the Site investigation and remediation activities may be necessary. If drum/container handling is necessary, it will be performed in accordance with applicable regulations.

4.2.1.1 Utilities

The Site may have shallow, buried utilities and also overhead utilities in certain areas. It will be necessary for parties disturbing the existing ground surface and conducting operations with heavy equipment having high clearances to exercise caution in performing project-related work with respect to the presence of utilities. Utility companies with active, buried lines in the Site area will be asked by the Contractor performing intrusive activities to mark their facilities. Employees will use these data to choose work locations.

4.2.1.2 Underground Utilities

No excavating, drilling, boring, or other intrusive activities will be performed until an underground utility survey, conducted by knowledgeable persons or agencies, has been made. This survey will identify underground and in-workplace utilities such as the following:

- Electrical lines and appliances;
- Telephone lines;
- Cable television lines;
- Gas lines;
- Pipelines;
- Steam lines;
- Water lines;
- Sewer lines; and/or
- Pressurized air lines.

The location of utilities will be discussed with GEI employees and subcontractors during a Site Safety Briefing. Identified utilities should be marked or access otherwise restricted to avoid chance of accidental contact.

Even when a utility search has been completed, drilling, boring, and excavation should commence with caution until advanced beyond the depth at which such utilities are usually located. Utilities will be considered "live" or active until reliable sources demonstrate otherwise.

4.2.2 Excavations and Trenches

The safety requirements for excavations and trenches must be determined by a competent person who is capable of identifying existing and predictable hazards and work conditions that are unsanitary, hazardous, or dangerous to GEI employees. The competent person must also have the authorization to take prompt corrective measures to eliminate unsatisfactory conditions. GEI employees will not enter trenches.

The following are general requirements for work activities in and around excavations:

- Prior to initiation of excavation activity (or ground intrusive activity, such as drilling), the location of underground installations will be determined. The NY Call Before You Dig center will be contacted by the Contractor/Subcontractor a minimum of 72 hours prior to excavation activities. It may also be necessary to temporarily support underground utilities during excavation. When excavations approach the estimated location of underground installations, the exact location of the underground installations will be determined by means that are safe for GEI employees, i.e., hand dig, test pits, etc.
- Excavations should be inspected daily by the excavating company's competent person prior to commencement of work activities. Evidence of cave-ins, slides, sloughing, or surface cracks or excavations will be cause for work to cease until necessary precautions are taken to safeguard employees.
- Excavated and other materials or equipment that could fall or roll into the excavation, and vehicular traffic and heavy equipment will be placed at least 5 feet from the edge of the excavation.
- Excavation operations will cease immediately during hazardous weather conditions such as high winds, heavy rain, lightning, and heavy snow.

Employees will refer to GEI's Excavation Safety SOP for further information.

4.2.3 Fire and Explosion

When conducting excavating activities, the opportunity for encountering fire and explosion hazards exists from contamination in soil and the possibility of free product in underground structures and pipelines. Additionally, the use of diesel-powered excavating equipment could present the possibility of encountering fire and explosion hazards.

4.2.4 Heat Stress

Employees may be exposed to the hazards associated with heat stress when ambient temperatures exceed 70ºF. Employees should increase water intake while working in conditions of high heat. Enough water should be available so that each employee can consume 1 quart of water per hour. In addition, they should increase number of rest breaks and/or rotate employees in shorter work shifts. Employees should rest in cool, dry, shaded areas for at least 5 minutes. Employees should not wait until they feel sick to cool down. Watch for signs and symptoms of heat exhaustion and fatigue. In the event of heat stroke, bring the victim to a cool environment, call for help, and initiate first aid procedures

The procedures to be followed regarding avoiding heat stress are provided in Appendix C – Heat Stress Guidelines and in GEI's Heat Stress program.

4.2.5 Cold Stress

Employees may be exposed to the hazards of working in cold environments. Potential hazards in cold environments include frostbite, trench foot or immersion foot, hypothermia, as well as slippery surfaces, brittle equipment, and poor judgment. The procedures to be followed regarding avoiding cold stress are provided in Appendix C – Cold Stress Guidelines and in GEI's Cold Stress program.

4.2.6 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. Employees who will perform suspected or established high noise tasks and operations will wear hearing protection. If deemed necessary by the SSO, the CHSO will be consulted on the need for additional hearing protection and the need to monitor sound levels for Site activities. Other employees who do not need to be in proximity of the noise should distance themselves from the equipment generating the noise.

4.2.7 Slips, Trips, and Falls

Working in and around the Site may pose slip, trip, and fall hazards due to slippery and uneven surfaces. Excavation at the Site may cause uneven footing in trenches and around the soil piles. Steep slope and uneven terrain conditions at the Site are also a primary concern. GEI employees will wear proper foot gear and will employ good work practice and housekeeping procedures to minimize the potential for slips, trips, and falls.

4.2.8 Manual Lifting

Manual lifting of objects and equipment may be required. Failure to follow proper lifting technique can result in back injuries and strains. Employees should use a buddy system and/or power equipment to lift heavy loads whenever possible and should evaluate loads before trying to lift them (i.e., they should be able to easily tip the load and then return it to its original position). Carrying heavy loads with a buddy and proper lifting techniques include: 1) make sure footing is solid; 2) make back straight with no curving or slouching; 3) center body over feet; 4) grasp the object firmly and as close to your body as possible; 5) lift with legs; and 6) turn with your feet, don't twist.

4.2.9 Projectile Objects and Overhead Dangers

Overhead dangers, including but not limited to falling debris and equipment, can occur while operating drill rigs. GEI employees will maintain a minimum distance from large overhead operations and to maintain proper communication with heavy equipment operators and their handlers, should work necessitate their presence beyond the minimum safety distance. Proper PPE will be worn during these types of activities including steel-toed/shank boots, safety vests, and hard hats.

4.3 Chemical Hazards

The characteristics of compounds at the Site are discussed below for information purposes. Adherence to the safety and health guidelines in this HASP should reduce the potential for exposure to the compounds discussed below:

Asbestos-Containing Materials

The Site potentially contains asbestos-containing materials (ACM) in the forms of demolition debris within the relief holder, ACM pipe insulation, and asbestos cement pipe. Chronic exposure to asbestos may cause asbestosis and mesothelioma. The primary route of exposure for asbestos is inhalation during the disturbance and/or removal of asbestos from the pipe insulation and cement pipes.

Asbestos is strictly regulated under OSHA 29 CFR 1910.1001/1926.1101. Employees that may be potentially exposed to ACM must participate in a medical surveillance program, have specific training in the hazards and controls of exposure to asbestos, and wear respirators with high efficiency particulate air (HEPA) filters. Work must be conducted in demarcated regulated areas to minimize the amount of people within the exposure area. Employers must conduct air sampling and provide signs and labels regarding the presence of asbestos.

Coal Tar and Coal Tar Products

Coal tar products, which are semi-volatile organic compounds (SVOCs) consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluorethene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphththalene, phenanthrene, phenols, pyrene.

Coal tar products and other SVOCs are present at the Site within impacted soil and groundwater and as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former manufactured gas plant (MGP) structures, and abandoned pipelines.

Coal tar products such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling, and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Coal tar is considered to be very toxic, if ingested. High levels of exposure to coal tar, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

The major route of entry for the work activities to be conducted at this Site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiate. It replaces the oxygen in the blood and thereby suffocates the cells. Ferro cyanides are not considered toxic because the hydrogen cyanide ion is bound too tightly to the iron and cannot therefore replace the oxygen. It takes a great amount of heat and/or acid to release cyanide gas from the ferro cyanide molecule; therefore, hydrogen cyanide is not a concern at this Site. However, it is National Grid’s policy to monitor for hydrogen cyanide during earth-disturbing activities at sites where MGP-related contaminants have been found.

Heavy Metals

Exposure to high concentrations of arsenic can cause dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, and hyper pigmentation of skin. Chronic exposure to arsenic has resulted in lung cancer in humans.

Exposure to high concentrations of aluminum can cause irritation of the eyes, skin, and the respiratory system.

Exposure to high concentrations of antimony can cause irritation of eyes, skin, nose, throat, and mouth; coughing; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; and could be unable to smell properly. Chronic exposure to antimony can produce respiratory effects that include antimony pneumoconiosis (inflammation of the lungs due to irritation caused by the inhalation of dust), alterations in pulmonary function, chronic bronchitis, chronic emphysema, inactive tuberculosis, pleural adhesions, irritation; cardiovascular effects (increased blood pressure, altered EKG readings and heart muscle damage) and gastrointestinal disorders in humans.

Exposure to high concentrations of beryllium can result in "beryllium sensitization", which is an allergic response to beryllium. Symptoms of the disease include cough, shortness of breath, fatigue, fevers, skin rash, and night sweats. In the later stages, lung tissue becomes scarred. In severe cases, the right side of the heart may be strained due to increased pressure in the pulmonary artery from lung damage.

Exposure to high concentrations of cadmium can cause acute symptoms such as pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness and pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; loss of the sense of smell), mild anemia; and is considered a potential occupational carcinogen.

Exposure to chromium can cause acute symptoms such as irritation of the eyes, nose and throat as well as wheezing and coughing. Chronic effects include nosebleeds, nasal congestion, dermatitis, and loss of sight.

Exposure to high concentrations of copper through inhalation can cause irritation of the eyes, nose, pharynx, nasal septum. Ingestion may cause a metallic taste. Skin irritation may result from direct contact with skin. Damage to the liver and kidneys may occur.

No adverse health effects are associated with environmental exposure to iron. Target organs for iron via ingestion of iron (most often in supplement form) are the liver, cardiovascular system, and kidneys. Exposure to high concentrations of iron through ingestion can cause salivation, nausea, vomiting, diarrhea, and abdominal pain.

Exposure to lead may cause acute symptoms such as eye irritation, weakness, weight loss, abdominal pain, and anemia. Chronic exposure to lead may result in kidney disease, effects to the reproductive system, blood forming organs, and CNS.

Lead and arsenic are regulated by specific OSHA standards. They are 29 CFR 1910.1025/1926.52 and 29 CFR 1910.1018/1926.1118, respectively. These standards include specific requirements for air monitoring, signs and labels, training and medical surveillance.

Exposure to high concentrations of manganese can cause manganism, metal fume fever, flu-like fever, and kidney damage.

Exposure to high concentrations of nickel may cause sensitization dermatitis, allergic asthma, and pneumonitis. Exposure to mercury can cause dizziness, salivation nausea, vomiting, diarrhea, constipation, emotional disturbance, and kidney injury. Chronic exposure to mercury can cause CNS damage.

Exposure to high concentrations of selenium can cause mucous membrane irritation, coughing, sneezing, shortness of breath, chills, headaches, hypotension, and CNS depression. Chronic exposure to selenium could cause bronchial irritation, gastrointestinal distress, excessive fatigue, and skin discoloration.

Exposure to high concentrations of thallium can cause nausea, diarrhea, abdominal pain, vomiting; tremor; chest pain, pulmonary edema; convulsions, psychosis; liver, kidney damage; and alopecia.

Vanadium may cause greenish-black discoloration of the tongue, and is possibly carcinogenic to humans. Long-term or repeated exposure to vanadium may have effects on the respiratory tract, resulting in chronic rhinitis and chronic bronchitis.

Exposure to high concentrations of zinc through ingestion can cause abdominal pain, nausea, vomiting, and diarrhea. Chronic exposure can lead to low blood pressure, jaundice, and seizures.

These metals are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. As with SVOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

Hydrogen Sulfide

Hydrogen sulfide is another common by-product of manufactured gas production. Exposure to lower concentrations can result in eye irritation, a sore throat and cough, shortness of breath, and fluid in the lungs. These symptoms usually go away in a few weeks. Long-term, low-level exposure may result in fatigue, loss of appetite, headaches, irritability, poor memory, and dizziness. Breathing very high levels (> 800 parts per million [ppm]) of hydrogen sulfide can cause death within just a few breaths. The primary route of exposure is through inhalation and therefore respiratory protection is the primary control against exposure to hydrogen sulfide.

SVOCs

Semi-volatile organic compounds (SVOCs) usually consist of a mixture of acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(b)fluoranthene, benzo(k)fluorethene, benz(a)pyrene, benzo(e)pyrene, benzo(g,h,i)peryline, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3cd)pyrene, 2-methyl naphthalene, naphththalene, phenanthrene, phenols, and pyrene.

These SVOCs are present at the Site within impacted soil and groundwater and as a dense non-aqueous phase liquid (DNAPL) by-product of gas production within soils, former manufactured gas plant (MGP) structures, and abandoned pipelines.

These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. SVOCs such as those listed above may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling, and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. Many SVOCs are considered to be very toxic, if ingested. High levels of exposure to SVOCs, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

The major route of entry for the work activities to be conducted at this Site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

Volatile Organic Compounds (VOC)

Volatile organic chemicals (VOCs), such as benzene, toluene, ethyl benzene, and xylene (BTEX) are present as soil and groundwater contaminants, and in some cases chemical components in non-aqueous phase liquids (NAPL) such as oil or tar within soils and abandoned pipelines. These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. These compounds generally have a depressant effect on the Central Nervous System (CNS), may cause chronic liver and kidney damage, and some are suspected human carcinogens. Benzene is a known human carcinogen. Acute exposure may include headache, dizziness, nausea, and skin and eye irritation. The primary route of exposure to VOCs is through inhalation and therefore respiratory protection is the primary control against exposure to VOCs.

PAHs

Polycyclic aromatic hydrocarbons (PAHs), are a group of chemicals consisting of numerous carbon atoms joined together to form multiple rings. Most are formed from the incomplete combustion of plant or animal matter, or carbon fuels, such as coal or petroleum. These compounds are at environmental concentrations and are not expected to be at concentrations that exposure symptoms would occur. PAHs may cause contact dermatitis. Direct contact can be irritating to the skin and produce itching, burning, swelling, and redness. Direct contact or exposure to the vapors may be irritating to the eyes. Conjunctivitis may result from prolonged exposure. High levels of exposure to PAHs, though not anticipated during work activities conducted during this project, may increase the risk of cancer including lung, kidney, and skin cancer. Naphthalene is also an eye and skin irritant and can cause nausea, headache, fever, anemia, liver damage, vomiting, convulsions, and coma. Poisoning may occur by ingestion of large doses, inhalation, or skin absorption.

The major route of entry for the work activities to be conducted at this Site is through direct contact. Exposure is most likely when handling soil and water samples. Inhalation may occur when the soil is disturbed causing respirable and nuisance dust particles to become airborne.

4.3.1 Evaluation of Organic Vapor Exposure

Air monitoring reduces the risk of overexposure by indicating when action levels have been exceeded and when PPE must be upgraded or changed. Action Levels for VOCs and associated contingency plans for the work zone are discussed within Section 9 of this HASP.

Exposure to organic vapors will be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photoionization detector (PID) or a flame ionization detector (FID).
- When possible, engineering control measures will be utilized to suppress the volatile organic vapors. Engineering methods can include utilizing a fan to promote air circulation, utilizing volatile suppressant foam, providing artificial ground cover, or covering up the impacted material with a tarp to mitigate volatile odors.

- When volatile suppression engineering controls are not effective and organic vapor meters indicate concentrations above the action levels, then appropriate respiratory protection (i.e., air purifying respirator with organic vapor cartridge) will be employed.

4.3.2 Evaluation of Skin Contact and Absorption

Skin contact by contaminants may be controlled by use of proper hygiene practices, PPE, and good housekeeping procedures. The proper PPE (e.g., Tyvek®, gloves, safety glasses) as described in Section 5 will be worn for activities where contact with potential contaminated media or materials are expected.

SDSs for decontamination chemicals and laboratory reagents that may be used on Site are included in Appendix B. Specific chemical hazards information from the occupational health sources are summarized in Table 3.

Table 4. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Asbestos	1332-21-4	0.1 f/cc	0.1 f/cc over 8 hr period or 1.0f/cc over 30 min.	Inhalation Ingestion Skin Contact	Asbestosis (chronic exposure); mesothelioma, breathing difficulty, interstitial fibrosis' restricted pulmonary function, finger clubbing; irritate eyes, potential carcinogen	Respiratory system, eyes	White, greenish, blue, or gray-green fibrous solids FP: NA IP: NA LEL: NA UEL NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 ppm TWA 5 ppm STEL	Inhalation Skin Absorption Ingestion Skin Contact	Irritation of eyes, skin, nose, respiratory system, giddiness, headache, nausea; staggering gait, fatigue, anorexia, weakness, dermatitis, bone marrow depression, potential carcinogen	Eyes, skin, CNS, bone marrow, blood	FP: 12° F IP: 9.24 eve LEL: 1.2% UEL:7.8% VP: 75 mm
Copper (as a fume)	1317-38-0	NIOSH REL: TWA 0.1 mg/m3	TWA 0.1 mg/m3	Inhalation, skin and/or eye contact	Irritation eyes, upper respiratory system; metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough, lassitude (weakness, exhaustion); metallic or sweet taste; discoloration skin, hair	Eyes, skin, respiratory system (increased risk with Wilson's disease)	Finely divided black particulate dispersed in air FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Ethylbenzene	100-41-4	100 ppm	100 ppm	Inhalation Ingestion Skin Contact	Eye, skin, mucous membrane irritation; headache; dermatitis, narcosis; coma	Eyes, skin, respiratory system, CNS	FP: 55° F IP: 8.76 eV LEL: 0.8% UEL:6.7% VP: 7 mm
Hydrogen cyanide	74-90-8	4.7 ppm (5 mg/m^3) STEL [skin]	10 ppm (11 mg/m^3) [skin]	Inhalation Ingestion Absorption Skin/Eye Contact	Asphyxia; weakness, headache, confusion; nausea, vomiting; increased rate and depth of respiration or respiration slow and gasping; thyroid, blood changes	CNS, CVS, thyroid, blood	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. VP: 630 mmHg IP: 13.60 eV

Table 4. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm C, 50 ppm [10-min. Maximum peak]	Inhalation Skin/Eye Contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, fatigue, irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, CNS	Colorless gas with a strong odor of rotten eggs. VP: 17.6 atm IP: 10.46 eV
Lead	7439-92-1	0.050 mg/m^3	0.05 mg/m^3 A.L. 0.03 mg/m3	Inhalation Ingestion Skin Contact	Weakness, insomnia; facial pallor; pal eye, anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis of wrist and ankles; irritates eyes, hypo tension	Eyes, GI tract, CNS, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Mercury	7439-97-6	0.025 mg/m^3	0.10 mg/m3	Inhalation Ingestion Skin Contact Skin Absorption	Irritates eyes and skin, chest pain, cough, difficulty breathing, bronchitis, pneumonitis, tremor, insomnia, irritability, indecision, headache, fatigue, weakness, stomatitis, salivation, Gastrointestinal disturbance, weight loss, proteinuria	Eyes, skin, respiratory tract, central nervous system	Silver-white, heavy odorless liquid FP: NA IP:? LEL: NA UEL:NA VP: 0.0012 mm

Table 4. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Nickel	7440-02-0 (Metal)	NIOSH REL*: Ca TWA 0.015 mg/m3 [*Note: The REL does not apply to Nickel carbonyl.]	TWA 1 mg/m3 [*Note: The PEL does not apply to Nickel carbonyl.]	Inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin **Cancer Site:** **[lung and nasal cancer]**	Metal: Lustrous, silvery, odorless solid FP: none LEL:N/A UEL: N/A VP: 0 mm
Naphthalene	91-20-3	10 ppm (52 mg/m3) TWA, 15 ppm (79 mg/m3) STEL	10 ppm (50 mg/m^3) TWA	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	FP: 174 F IP: 8.12 eV, LEL: 0.8% UEL:6.7%, VP: 0.08 mm
PAH's as Coal Tar Pitch Volatiles (CTPV)	65996-93-2	0.2 mg/m3	0.2 mg/m3	Inhalation Ingestion Skin Contact	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, CNS, liver, kidneys, skin, bladder, carcinogen	Black or dark brown amorphous residue.
Toluene	108-88-3	50 ppm	200 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, nose irritation; fatigue, weakness, confusion, euphoria, dizziness, headache; dilated pupils, tearing of eyes; nervousness, muscle fatigue, insomnia, tingling in limbs; dermatitis	Eyes, skin, respiratory system, CNS, liver, kidneys	FP: 40^{o}F IP: 8.82 eV LEL: 1.1% UEL:7.1% VP: 21 mm

Table 4. Chemical Data

Compound	CAS #	ACGIH TLV	OSHA PEL	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion, Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; incoordination, staggering gait; corneal damage; appetite loss, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, Central Nervous System, GI tract, blood, liver, kidneys	FP: 90° F LEL: 0.9% UEL: 6.7% VP: 9 mm
Zinc	1314-13-2	5 mg/m3 (TWA), 10 mg/m3 (STEL) for zinc oxide fume	10 mg/m3 (TWA), for zinc oxide fume	Inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Respiratory system	Colorless liquid FP: NA? IP: 11 eV LEL: 7.5% UEL: 12.5% VP: 100 mmHg

Abbreviations:

°F = degrees Fahrenheit
ACGIH = American Conference of Industrial Hygienists
A.L. = Action Level
atm = atmosphere
C = ceiling limit, not to be exceeded
CAS # = chemical abstract services number
CNS = Central Nervous System
CTPV = Coal Tar Pitch Volatiles
CVS = Cardiovascular System
eV = electron volt
f/cc = fibers per cubic centimeter
FP = Flash point
GI = Gastro-intestinal
H2S = Hydrogen Sulfide
HCN = Hydrogen Cyanide
hr = hour
IP = Ionization Potential
LEL = Lower explosive limit
mg/m^3 = micrograms per cubic meter
min = minute
mm = millimeter
mmHg = millimeters of mercury
N/A = not applicable
OSHA = Occupational Safety and Health Administration
PAH = Polycyclic Aromatic Hydrocarbons
PCB = Polychlorinated Biphenyls
PEL = Permissible exposure limit
ppm = parts per million
Skin = significant route of exposure
STEL = Short-term exposure limit (15 minutes)
TWA = Time-weighted average (8 hours)
VP = vapor pressure approximately 68°F in mm Hg

4.4 Biological Hazards

Areas of the Site may be wooded, surrounded with brush, or landscaped. Therefore, employees working on this project should be aware of the potential biological hazards at this Site. Each is discussed in detail below:

4.4.1 Ticks

4.4.1.1 Lyme Disease

Ticks are bloodsuckers, attaching themselves to warm-blooded vertebrates to feed. Deer ticks are associated with the transmission the bacteria that causes Lyme disease. Female deer ticks are about ¼-inch in length and are black and brick red in color. Males are smaller and all black. If a tick is not removed, or if the tick is allowed to remain for days feeding on human blood, a condition known as tick paralysis can develop. This is due to a neurotoxin, which the tick apparently injects while engorging. This neurotoxin acts upon the spinal cord causing incoordination, weakness, and paralysis.

The early stages of Lyme disease, which can develop within a week to a few weeks of the tick bite, are usually marked by one or more of these signs and symptoms:

- Tiredness
- Chills and fever
- Headache
- Muscle and/or join pain
- Swollen lymph glands
- Characteristic skin rash (i.e. bullseye rash)

4.4.1.2 Rocky Mountain Spotted Fever

Rocky Mountain spotted fever is spread by the American dog tick, the lone-star tick, and the wood tick, all of which like to live in wooded areas and tall, grassy fields. The disease is most common in the spring and summer when these ticks are active, but it can occur anytime during the year when the weather is warm.

Initial signs and symptoms of the disease include sudden onset of fever, headache, and muscle pain, followed by development of a rash. Initial symptoms may include fever, nausea, vomiting, severe headache, muscle pain, and/or lack of appetite.

The rash first appears 2 to 5 days after the onset of fever and is often not present or may be very subtle. Most often it begins as small, flat, pink, non-itchy spots on the wrists, forearms, and ankles. These spots turn pale when pressure is applied and eventually become raised on the skin. Later signs and symptoms include rash, abdominal pain, joint pain, and/or diarrhea.

The characteristic red, spotted rash of Rocky Mountain spotted fever is usually not seen until the 6^{th} day or later after onset of symptoms, and this type of rash occurs in only 35% to 60% of patients with Rocky Mountain spotted fever. The rash involves the palms or soles in as many as 50% to 80% of patients; however, this distribution may not occur until later in the course of the disease.

4.4.1.3 Prevention

Tick season lasts from April through October; peak season is May through July. You can reduce your risk by taking these precautions:

- During outside activities, wear long sleeves and long pants tucked into socks. Wear a hat, and tie hair back.
- Use insecticides to repel or kill ticks. Repellents containing the compound n,n-diethyl-meta-toluamide (DEET) can be used on exposed skin except for the face, but they do not kill ticks and are not 100% effective in discouraging ticks from biting. Products containing permethrin kill ticks, but they cannot be used on the skin -- only on clothing. When using any of these chemicals, follow label directions carefully.
- After outdoor activities, perform a tick check. Check body areas where ticks are commonly found: behind the knees, between the fingers and toes, under the arms, in and behind the ears, and on the neck, hairline, and top of the head. Check places where clothing presses on the skin.
- Remove attached ticks promptly. Removing a tick before it has been attached for more than 24 hours greatly reduces the risk of infection. Use tweezers, and grab as closely to the skin as possible. Do not try to remove ticks by squeezing them, coating them with petroleum jelly, or burning them with a match. Keep ticks in a zip-lock baggie in case testing needs to be performed.
- Report any of the above symptoms and all tick bites to the PM and CHSO for evaluation.

4.4.2 Mosquito- Borne Disease – West Nile Virus

West Nile encephalitis is an infection of the brain caused by the West Nile virus, which is transmitted by infected mosquitoes. Following transmission from an infected mosquito, West Nile virus multiplies in the person's blood system and crosses the blood-brain barrier to reach the brain. The virus interferes with normal CNS functioning and causes inflammation of the brain tissue. However, most infections are mild and symptoms include fever, headache, and body aches. More severe infections may be marked by headache, high fever, neck stiffness, stupor, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and rarely, death. Persons over the age of 50 have the highest risk of severe disease.

Prevention centers on public health action to control mosquitoes and on individual action to avoid mosquito bites. To avoid being bitten by the mosquitoes that cause the disease, use the following control measures:

If possible, stay inside between dusk and dark. This is when mosquitoes are most active. When outside (between dusk and dark), wear long pants and long-sleeved shirts. Spray exposed skin with an insect repellent, preferably containing DEET.

4.4.3 Wasps and Bees

Wasps (hornets and yellow-jackets) and bees (honeybees and bumblebees) are common insects that may pose a potential hazard to the field team if work is performed during spring, summer, or fall. Bees normally build their nests in the soil. However, they use other natural holes such as abandoned rodent nests or tree hollows. Wasps make a football-shaped, paper-like nest either below or above the ground. Yellow-jackets tend to build their nests in the ground but hornets tend to build their nests in trees and shrubbery. Bees are generally more mild-mannered than wasps and are less likely to sting. Bees can only sting once while wasps sting multiple times because their stinger is barbless. Wasps sting when they feel threatened. By remaining calm and not annoying wasps by swatting, you lessen the chance of being stung.

Wasps and bees inject a venomous fluid under the skin when they sting. The venom causes a painful swelling that may last for several days. If the stinger is still present, carefully remove it with tweezers. Some people may develop an allergic reaction (i.e. anaphylactic shock) to a wasp or bee sting. If such a reaction develops, seek medical attention at once. If a GEI employee is allergic to bees or wasps notify the SSO and if, needed, the location of the epi pen.

4.4.4 Sun Exposure

Employees are encouraged to liberally apply sunscreen, with a minimum sun protection factor (SPF) of 15, when working outdoors to avoid sunburn and potential skin cancer, which is associated with excessive sun exposure to unprotected skin. Additionally, employees should wear safety glasses that offer protection from ultraviolet A and B (UVA/UVB) rays.

5. Personal Protective Equipment

The PPE specified in Table 5 represents PPE selection required by 29 CFR 1910.132, and is based on the Activity Hazard Analysis of Section 4 (Table 3). Specific information on the selection rationale activity can be found in the GEI Health and Safety Manual.

The PPE program addresses elements, such as PPE selection based on Site hazards, use and limitations, donning and doffing procedures, maintenance and storage, decontamination and disposal, training and proper fitting, inspection procedures prior to / during / and after use, evaluation of the effectiveness of the PPE program, and limitations during temperature extremes, heat stress, and other appropriate medical considerations. A summary of PPE for each level of protection is in Table 5.

Table 5. Summary of PPE by Level

Task	PPE Level	Site-Specific Requirements	Respirator
Mobilization/Demobilization			
Reconnaissance	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Mobilization/Demobilization of Equipment and Supplies	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D – None
Establishment of Site Security, Work Zones, and Staging Area	D	Hard hat, safety glasses, steel toe/shank safety boot, reflective vest, leather work gloves, hearing protection as needed	D - None
Construction			
Drilling, Groundwater Well Installation, Excavation, Digging Test Pits, Backfilling, Grading Observation, Sampling	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)
Hazardous Materials Assessment			
Sampling: Caulking, Paint, Concrete, Brick, and Soil	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)
Demolition/Remediation Observation			
Observe Contractor Activities	D	Hard hat, safety glasses, steel toe/shank safety boot with overboot as needed, reflective vest, leather work gloves as needed, nitrile gloves, hearing protection as needed, Tyvek as needed	Level D initially, Level C-If action levels exceeded (see Section 9 of HASP)

Use of Level A or Level B PPE is not anticipated. If conditions indicating the need for Level A or Level B PPE are encountered, personnel will leave the Site and this HASP will be revised with oversight of the CHSO or GEI personnel will not re-enter the Site until conditions allow.

For most work conducted at the site, Level D PPE will include long pants, hard hats, safety glasses with side shields, and steel toe/shank or EH-rated safety boots. When work is conducted in areas where non-aqueous phase liquid (NAPL) or tar-saturated soil is anticipated, employees will wear, at a minimum, Level D PPE, which can also include Tyvek® coveralls and safety boots with overboots.

5.1 OSHA Requirements for PPE

Personal protective equipment used during the course of this field investigation must meet the following OSHA standards:

Table 6. OSHA Standards for PPE

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133	ANSI Z87.1 1968
Respiratory	29 CFR 1910.134	ANSI Z88.1 1980
Head	29 CFR 1910.135	ANSI Z89.1 1969
Foot	29 CFR 1910.136	ANSI Z41.1 1999 or ASTM F-2412-2005, and ASTM F-2413-2005

CRF = Code of Federal Regulations
ANSI = American National Standards Institute
ASTM = American Society For Testing and Materials

On-site GEI personnel who have the potential to don a respirator must have a valid fit test certification and documentation of medical clearance. The CHSO will maintain such information on file for on-site personnel. The PM will obtain such information from the subcontractor's site supervisor prior to the initiation of such work. Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.134). Air purifying respirators cannot be worn under the following conditions:

- Oxygen deficiency (less than 20.7%).
- Imminent Danger to Life and Health (IDLH) concentrations.
- If contaminant levels exceed designated use concentrations.

6. Key Project Personnel/Responsibilities and Lines of Authority

6.1 GEI Personnel

• Melissa Felter	GEI Project Manager
• Matthew O'Neil	GEI Project Engineer
• TBD	GEI Site Safety Officer
• Robin B. DeHate	GEI Corporate Health and Safety Officer
• Steven Hawkins	Regional Health and Safety Officer

The implementation of health and safety at this project location will be the shared responsibility of the PM, the CHSO, the SSO, other GEI personnel implementing the proposed scope of work.

6.1.1 GEI Project Manager

The PM, Melissa Felter, is responsible for confirming that the requirements of this HASP are implemented. Some of the PM's specific responsibilities include:

- Conducting and documenting the Project Safety Briefing for GEI project employees and forwarding the signed form (Appendix D) to the Health and Safety Committee;
- Verifying that the GEI staff selected to work on this program are sufficiently trained for Site activities;
- Assuring that personnel to whom this HASP applies, including subcontractor personnel, have received a copy of it;
- Providing the CHSO with updated information regarding conditions at the Site and the scope of Site work;
- Providing adequate authority and resources to the on-site SSO to allow for the successful implementation of necessary safety procedures;
- Supporting the decisions made by the SSO and CHSO;
- Maintaining regular communications with the SSO and, if necessary, the CHSO;
- Verifying that the subcontractors selected by GEI to work on this program have completed GEI environmental, health and safety requirements and has been deemed acceptable for the proposed scope of work; and

- Coordinating the activities of GEI subcontractors and confirming that they are aware of the pertinent health and safety requirements for this project.

6.1.2 GEI Corporate Health and Safety Officer

The CHSO, Robin DeHate, is the individual responsible for the review, interpretation, and modification of this HASP. Modifications to this HASP which may result in less stringent precautions cannot be undertaken by the PM or the SSO without the approval of the CHSO. Specific duties of the CHSO include:

- Writing, approving, and amending the HASP for this project;
- Advising the PM and SSO on matters relating to health and safety on this Site;
- Recommending appropriate PPE and safety equipment to protect personnel from potential Site hazards;
- Conducting accident investigations; and
- Maintaining regular contact with the PM and SSO to evaluate Site conditions and new information which might require modifications to the HASP.

6.1.3 GEI Site Safety Officer

GEI field staff are responsible for implementing the safety requirements specified in this HASP. However, one person will serve as the SSO. For this program, TBD, will serve as the SSO. The SSO will be on-site during all activities covered by this HASP. The SSO is responsible for enforcing the requirements of this HASP once work begins. The SSO has the authority to immediately correct situations where noncompliance with this HASP is noted and to immediately stop work in cases where an immediate danger is perceived. Some of the SSO’s specific responsibilities include:

- Conducting/attending the Project Safety Briefing prior to beginning work, and subsequent safety meetings as necessary;
- Conduct daily Safety Tailgate meeting in accordance with National Grid requirements (can be combined with “pre-entry”) briefing for Site-related work;
- Verifying that personnel to whom this HASP applies have attended and participated in the Project Safety Briefing and subsequent safety meetings that are conducted during the implementation of the program;
- Maintaining a high level of health and safety consciousness among employees implementing the proposed activities;

- Procuring the air monitoring instrumentation required and performing air monitoring for investigative activities;
- Procuring and distributing the PPE and safety equipment needed for this project for GEI employees;
- Verifying that PPE and health and safety equipment used by GEI is in good working order;
- Verifying that the selected contractors are prepared with the correct PPE and safety equipment and supplies;
- Notifying the PM of noncompliance situations and stopping work in the event that an immediate danger situation is perceived;
- Monitoring and controlling the safety performance of personnel within the established restricted areas to confirm that required safety and health procedures are being followed;
- Stopping work in the event that an immediate danger situation is perceived; and
- Reporting accident/incident and preparing accident/incident reports, if necessary.

6.1.4 GEI Field Personnel

GEI field personnel covered by this HASP are responsible for following the health and safety procedures specified in this HASP and for performing their work in a safe and responsible manner. Some of the specific responsibilities of the field personnel are as follows:

- Reading and signing the HASP in its entirety prior to the start of on-site work;
- Attending and actively participating in the required Project Safety Briefing prior to beginning on-site work and any subsequent safety meetings that are conducted during the implementation of the program;
- Stopping work in the event that an immediate danger situation is perceived;
- Bringing forth any questions or concerns regarding the content of the HASP to the PM or the SSO, prior to the start of work;
- Reporting accidents, injuries, and illnesses, regardless of their severity, to the SSO, CHSO, and HR; and
- Complying with the requirements of this HASP and the requests of the SSO.

6.1.5 Lines of Authority will be as follows:

On Site – GEI will have responsibility for safety of its employees during the work performed at the Site Skillman Street Former Holder Station. GEI's field representative will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. GEI's field representative will be available for communication with the GEI PM and with the National Grid representative.

GEI and Subcontractor employees have the authority to stop work activities if an unanticipated hazard is encountered or a potential unsafe condition is observed. The GEI employee should contact the Corporate Health and Safety Officer and the Project Manager to discuss the stop work conditions and potential control methods that can be implemented.

6.2 Subcontractors

GEI does not anticipate having subcontractors as part of this project.

GEI requires its subcontractors to work in a responsible and safe manner. Subcontractors for this project will be required to develop their own HASP for protection of their employees, but, at a minimum, must adhere to applicable requirements set forth in this HASP.

7. Training Program

7.1 HAZWOPER Training

In accordance with OSHA Standard 29 CFR 1910.120 "Hazardous Waste Operations and Emergency Response" (HAZWOPER) responders will, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training will have consisted of instruction in the topics outlined in the standard. Personnel who have not met the requirements for initial training will not be allowed to work in any Site activities in which they may be exposed to hazards (chemical or physical). Proof of training will be submitted to the PM or his/her representative prior to the start of field activities.

7.2 Annual 8-Hour Refresher Training

Annual 8-hour refresher training will be required of hazardous waste site field personnel in order to maintain their qualifications for fieldwork. The training will cover a review of 29 CFR 1910.120 requirements and related company programs and procedures. Proof of current 8-hour refresher training will be submitted to the PM or his/her representative prior to the start of field activities.

7.3 Supervisor Training

Personnel acting in a supervisory capacity will have received 8 hours of instruction in addition to the initial 40-hour training. In addition supervisors will have 1 year of field experience and training specific to work activities (i.e., sampling, construction observation, etc.)

7.4 Site-Specific Training

Prior to commencement of field activities, the PM or the SSO will verify GEI field personnel assigned to the project will have completed training that will specifically address the activities, procedures, monitoring, and equipment used in the Site operations. It will include Site and facility layout, hazards, and emergency services at the Site, and will highlight the provisions contained within this HASP and applicable GEI H&S SOPs (Appendix E). This training will be documented on the Project Safety Briefing Form Appendix D). The signed form will be forwarded to the Health and Safety Committee at HealthandSafety@geiconsultants.com. In addition, GEI personnel will sign the plan to document that they understand the hazards and control measures presented and agree to comply with the procedures established in the HASP. Personnel that have not received project-specific training will not be allowed on-site.

7.5 On-Site Safety Briefings

Other GEI personnel will be given health and safety briefings daily by the SSO or field representative to assist GEI personnel in safely conducting work activities. The briefing will include GEI subcontractors. The briefings can include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions, as well as periodic reinforcement of previously discussed topics. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety inspections. Documentation of these briefings will be recorded in the GEI field book, if the project duration is less than 5 days. If the project is longer than 5 days, the Tailgate Safety Briefing Form (Appendix D) will be used to document briefings. The meetings will also be an opportunity to periodically update the employees on monitoring results.

7.6 First Aid and CPR

The PM will verify that GEI field staff have current certifications in first aid and Cardiopulmonary Resuscitation (CPR), so that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association. GEI employees also attend annual Bloodborne Pathogens training in compliance with OSHA regulations.

8. Medical Surveillance Program

GEI maintains a continuous, corporate, medical surveillance program that includes a plan designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. Robin DeHate is GEI's CHSO and is responsible for the administration and coordination of medical evaluations conducted for GEI's employees at branch office locations. Comprehensive examinations are given to GEI field personnel on an annual or biennial basis (as determined to be appropriate by the CHSO) participating in hazardous waste operations. The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Under the CHSO's supervision, field personnel undergo a complete initial physical examination, including a detailed medical and occupational history, before they participate in hazardous waste site investigations. Extensive annual/biennial reexaminations are also performed. Upon completion of these tests, personnel are certified by an occupational health physician as to whether they are fit for field work in general, and fit to use respiratory protection.

If a GEI employee or other project worker shows symptoms of exposure to a hazardous substance and wishes to be rechecked, he/she will be directed to the nearest area hospital or medical facility.

GEI subcontractor personnel that will enter any active waste handling or other active non-"clean" area must certify that they are participating in a medical surveillance program that complies with OSHA regulations for hazardous waste operations (i.e., 29 CFR 1910.120 and 29 CFR 1926.65). Proof of medical clearance will be submitted to the GEI PM or SSO prior to the start of field activities.

9. Monitoring

Air monitoring will be performed to identify and quantify airborne levels of hazardous substances and safety and health hazards in order to determine the appropriate level of worker protection needed on-site in the event that intrusive work is conducted.

GEI may conduct perimeter air monitoring, and work zone monitoring for on-site GEI employees during intrusive activities only. Activities requiring air monitoring will be conducted in accordance with a pre-approved work plan. GEI will monitor and document daily Site conditions and operations and inform field representatives of results. If Action Levels are exceeded, the SSO will immediately implement Site action(s) according to Table 6 below and notify the PM and CHSO.

GEI will provide the following equipment for health and safety monitoring of on-site GEI personnel:

- PID with 10.6 eV lamp or equivalent;
- Drager Chip Measurement System (CMS) with appropriate gas detection chips;
- Sensidyne Gas Detection Pump with appropriate gas detector tubes;
- Particulate Meter (PM-10 capable)
- Combustible Gas Indicator (CGI): LEL / Oxygen (O_2) / hydrogen sulfide (H_2S) / hydrogen cyanide (HCN) meter;
- Sound Level Meter by the PM and CHSO, type to be appropriate to the activities performed.

Air monitoring equipment will be calibrated and maintained in accordance with manufacturer's requirements. Calibrations will be recorded in the project notes daily or on a daily calibration form.

Organic vapor concentrations will be measured using a PID during intrusive activities. During intrusive operations, organic vapor concentrations will be measured continuously. Organic vapor concentrations will be measured upwind of the work site(s) to determine background concentrations at least twice a day, (once in the morning and once in the afternoon). The SSO will interpret monitoring results using professional judgment and according to the alert and Action Limits set forth in the associated Site Work Plan.

A dust meter will be used to measure airborne particulate matter during intrusive activities. Monitoring will be continuous and readings will be averaged over a 15-minute period for comparison with the Action Levels. Monitoring personnel will make a best effort to collect dust monitoring data from downwind of the intrusive activity. If off-site sources are considered to be the source of the measured dust, upwind readings will also be collected.

A multi-gas meter will be used to monitor for combustible gases and O_2 content in the work zone during intrusive activities. The multi-gas meter will also be equipped with an H_2Ssensor and an HCN sensor. H_2S monitoring will be completed every 15 minutes or, if a sulfur odor is present, monitoring will be continuous. HCN monitoring will be completed every 15 minutes or, if an almond odor is detected, monitoring will be continuous.

The perimeter and work zone air monitoring will be conducted during demolition activities. Table 7 provides a summary of real time air monitoring Action Levels and contingency plans for work zone activities. The below Action Levels are determined by halving the Permissible Exposure Limits (PELs) or Threshold Limit Values (TLVs) as set forth by OSHA and the American Conference of Government Industrial Hygienists (ACGIH). O_2 values are based on the maximum use limits of a full face respirator if oxygen were being displaced by a chemical.

Table 7. Real-Time Work Zone Air Monitoring Action Levels

Air Monitoring Instrument	Monitoring Location	Action Level (above background)	Site Action
PID	Work Zone	1.0 ppm	Use detector tube for benzene or zNose® to verify if concentration is benzene. No respiratory protection is required if benzene is not present.
PID	Work Zone	10 ppm	Use Sensidyne detector tube for naphthalene or zNose® to verify if concentration is naphthalene. No respiratory protection is required if naphthalene is not present.
		10 – 50 ppm	No respiratory protection is required if benzene or naphthalene is not present.
		50 – 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels persist, upgrade to Level C.
		> 100 ppm	Stop work, withdraw from work area, notify PM and CHSO.
O_2 Meter	Work Zone	< 20.7%	Stop work, withdraw from work area, ventilate area, notify PM and CHSO.
		> 21.1%	Stop work, withdraw from work area, notify PM and CHSO.
H_2S Meter	Work Zone	< 5.0 ppm	No respiratory protection is required.
		> 5.0 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, notify PM and CHSO.
HCN Meter	Word Zone	< 1.0 ppm	Run CMS Drager tube. Continue monitoring with real-time meter, and continue work if CMS Drager tube reading is less than 2.0 ppm.
		> 1.0 ppm HCN Concentrations < 2.0 ppm	Run CMS Drager tube and confirm concentration is less than 2.0 ppm, notify PM and CHSO. Run CMS tube for sulfur dioxide, hydrogen sulfide, and phosphine chip potential interferences. Continue to monitor with real-time meter.
		> 2.0 ppm	Stop work, and move (with continuous HCN monitoring meter) at lease 25 ppm upwind of the excavation until continuous meter reads less than 1 ppm, notify PM and CHSO. Run CMS Drager hydrogen cyanide chip and re-evaluate activity, continue monitoring with a real-time meter, resume work if concentrations read less than 1.0 ppm.
CGI	Work Zone	< 10% LEL	Investigate possible causes, allow excavation to ventilate, use caution during procedures.
		> 10% LEL	Stop work, allow excavation/borehole to ventilate to < 10% LEL, if ventilation does not result in a decrease to < 10% LEL, withdraw from work area, notify PM and CHSO.
Particulate Meter	Work Zone	150 µg/m^3	Implement work practices to reduce/minimize airborne dust generation, e.g., spray/misting of soil with water.

10. Site Control Measures

10.1 Site Zones

Site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. A three-zone approach will be utilized. It will include an Exclusion Zone (EZ), Contamination Reduction Zone (CRZ) and a Support Zone (SZ). Specific zones will be established on the work site by the Contractor when operations begin for each task requiring such delineation. Maps depicting the zones will be available at the Site.

This project is being conducted under the requirements of 29 CFR 1910.120, and any personnel working in an area where the potential for exposure to Site contaminants exists, will only be allowed access after proper training and medical documentation.

The following will be used for guidance in revising these preliminary zone designations, if necessary.

Support Zone – The SZ is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for medical emergency. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel/materials are not allowed in this zone.

Contamination Reduction Zone – The CRZ is established between the EZ and the SZ. The CRZ contains the contamination reduction corridor and provides an area for decontamination of personnel and portable hand-held equipment, tools and heavy equipment. A personnel decontamination area will be prepared at each exclusion zone. The CRZ will be used for EZ entry and egress in addition to access for heavy equipment and emergency support services.

Exclusion Zone – Activities which may involve exposure to Site contaminants, hazardous materials, and/or conditions should be considered an EZ. This zone will be clearly delineated by cones, tapes, or other means. The Contractor may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ will be determined by the Contractor allowing adequate space for the activity to be completed, field members, and emergency equipment.

The Contractor is responsible for constructing, maintaining, and enforcing the zones.

10.2 Buddy System

GEI personnel should be in line-of-site or communication contact with another on-site person. The other on-site person should be aware of his or her role as a "buddy" and be able to provide assistance in the event of an emergency. A copy of this plan will be given to any person acting as a GEI "buddy" for informational purposes.

10.3 Sanitation for Temporary Work Sites

Temporary sanitary facilities including toilets will be available on-site.

10.4 Illumination

Illumination requirements identified by OSHA are directed to work efforts inside buildings and/or during non-daylight hours. Activities planned for the Site are anticipated to occur outside during daylight hours. However, if yard areas are used after dark, they will be equipped with illumination that meets or exceeds requirements specified in OSHA Standard 29 CFR 1926.56 "Illumination." Employees will not work on sites that are not properly lighted.

11. Accident Reporting

GEI will report incidents involving GEI personnel or subcontractor personnel, such as lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage. The report will be made to the GEI PM **verbally** as soon as possible, but **no later than 0.5 hours** of the incident. The PM will **immediately** inform the CHSO, the Director of Human Resources and a Project-Specific National Grid Representative of **any accident, incident, injury or near miss.** A GEI Accident Report form will be submitted within **2 hours of the incident.** A DRAFT Incident Report Form will be completed and submitted to the Project-Specific National Grid Representative **within 4 hours**. An incident reporting flow chart, the Accident/Incident Report Forms and the Near Miss Reporting Form can be found in Appendix D. GEI report forms can also be found on the GEI Health and Safety smartphone app or on the Health and Safety page of the GEI Intranet.

Staff must be aware that addressing accidents and injuries takes precedence over completing field work. If a staff member requires medical attention, or an incident/accident has occurred that call this into question, work must stop and the situation must be addressed.

11.1 Injury Triage Service

If a GEI employee experiences a work-related injury that is not life-threatening, the employee will initiate a call to Medcor Triage at 1-800-775-5866. The injured employee will detail any medical symptoms or complaints which will be evaluated by a Registered Nurse (RN) specially trained to perform telephonic triage. The RN will recommend first aid self-treatment or refer the injured employee for an off-site medical evaluation by a health professional at a clinic within GEI's workers compensation provider network. GEI employees are still required to follow our Accident Reporting procedures as listed above.

11.2 Flow Chart for Accident Reporting

Employee

GEI reports incidents involving GEI personnel or subcontractor personnel including lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage.

Employee

The report is made to the GEI PM verbally **within 0.5 hour** of the incident.

PM

The PM **immediately** notifies the CHSO, Human Resources and the Project-Specific National Grid Representative for the incident. In addition, the PM will notify the GEI National Grid Client Manager.

CHSO

The CHSO informs the President, COO and Regional Manager of the incident.

Employee

The GEI Accident/Incident Report form is completed by the injured employee and submitted to the CHSO and HR within ***2 hours*** of the incident.

PM with assist from CHSO or RHSO

A ***DRAFT*** Incident Report Form found in the appendix of the HASP is completed and submitted to the Project-Specific National Grid Representative **within 4 hours** of the incident.

RHSO

The GEI Regional Health and Safety Officer initiate an accident investigation within 24 hours of the receipt of the accident report.

RHSO

The accident investigation report is submitted to the CHSO for approval.

CHSO

Incidents are reported to the Operations Committee each month in the H&S report.

12. Decontamination Procedures

A decontamination procedure will be established for personnel decontamination and equipment decontamination.

12.1 Personnel Decontamination Station

A personnel decontamination station where employees can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor. It will be equipped with basins for water and detergent, and trash bag(s), or cans for containing disposable PPE and discarded materials. Once personnel have decontaminated at this station and taken off their PPE, they will proceed to a sink where they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.)

The following specific decontamination procedure will be used as necessary by GEI personnel or subcontractor personnel wearing PPE from Level D through Level C.

- ***Step 1 –*** Equipment drop (respirator, tools, monitoring equipment, etc.) Decontaminate as appropriate (per GEI's field representative's instructions).
- ***Step 2 –*** Boot wash/rinse (wash with non-foaming detergent, rinse with fresh water spray). Remove boots. If inner and outer gloves are worn, wash outer gloves, remove and save for later use, or remove and discard outer gloves and place in trash bag/can provided in the decontamination area.
- ***Step 3 –*** Hard hat removal; wash if visibly contaminated (use same wash as in Step 2).
- ***Step 4 –*** If Tyvek® (or equivalent) suit was worn and is visibly contaminated, remove and place in trash bag/can provided in the decontamination area or decontaminate (wash) and store for reuse. Contaminated washable coveralls should be removed and bagged for washing.
- ***Step 5 –*** Respirator and/or eye protection removal (as applicable). Wash (per Step 2) to remove visible contamination.
- ***Step 6 –*** Remove outer gloves.
- ***Step 7 –*** Wash potentially exposed skin (use water and soap at indoor sink).
- ***Step 8 –*** Disinfect respirator per manufacturer's recommendations.

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate containers) and disposed of in an approved facility.

Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with applicable state and federal regulations.

12.2 Heavy Equipment Decontamination

Heavy equipment decontamination will be performed by the Contractor within the limits of the on-site decontamination pad in accordance with the contract specifications. A steam generator and brushes will be used to clean demolition equipment and other tools. No heavy equipment will be permitted to leave the Site unless it has been thoroughly decontaminated.

Wastewater from the heavy equipment and personnel decontamination areas will be collected and disposed of in accordance with applicable state and federal regulations. The Contractor will be responsible for ultimate disposal of investigation-derived wastes.

12.3 Decontamination Equipment Requirements

The following equipment, if required, should be in sufficient supply to implement decontamination procedures for GEI's equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handled soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol and/or Nitric Acid
- Liquid detergent and paper towels
- Plastic trash bags

The Contractor performing decontamination procedures is responsible for verifying that the above materials, as required for their operation, are in sufficient supply.

13. Supplemental Contingency Plan Procedures

13.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their annual health and safety training and new employee health and safety orientation training. Hazardous materials used on the Site will be properly labeled, stored, and handled. SDS will be available to potentially exposed employees.

13.2 Fire

In the event of a fire personnel will evacuate the area. GEI's field representative will contact the local fire department with jurisdiction and report the fire. Notification of evacuation will be made to the PM, the CHSO, and the Project Specific National Grid Representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM.

13.3 Medical Support

In case of minor injuries, on-site care will be administered with the Site first aid kit. For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger. Notify the PM, the CHSO, and the Project Specific National Grid Representative of the emergency.

Section 1 and Table 1 of this HASP contain detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. In addition, Appendix A includes maps to the hospital and/or occupational health clinic. GEI field personnel will carry a cellular telephone.

13.4 Severe Weather

The contingency plan for severe weather includes reviewing the expected weather to determine if severe weather is in the forecast. Severe weather includes high winds over 30 miles per hour (mph), heavy rains or snow squalls, thunderstorms, tornados, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the Site will be the responsibility of GEI's field representative. Notification of evacuation will be made to the PM, the CHSO, and the Project Specific National Grid Representative. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM. If safe, work can resume 30 minutes after the last clap of thunder or flash of lightning.

13.5 Spills or Material Release

If a hazardous waste spill or material release occurs, if safe, the SSO or their representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following:

- SDS for the material spilled or released;
- Source of the release or spillage of hazardous material;
- An estimate of the quantity released and the rate at which it is being released;
- The direction in which the spill or air release is moving;
- Personnel who may be or may have been in contact with the material, or air release, and possible injury or sickness as a result;
- Potential for fire and/or explosion resulting from the situation; and
- Estimates of area under influence of release.

If the spill or release is determined to be within the on-site emergency response capabilities, the SSO will verify implementation of the necessary remedial action. If the release is beyond the capabilities of the Site personnel, personnel will be evacuated from the immediate area and the local fire department will be contacted. The SSO will notify the PM, the CHSO, and the Project Specific National Grid Representative.

13.6 Alcohol and Drug Abuse Prevention

Alcohol and drugs will not be allowed on the work Site. Project personnel under the influence of alcohol or drugs will not be allowed to enter the Site.

14. Health and Safety Plan Sign-Off

GEI personnel conducting site activities will be familiar with the information in this HASP. After reviewing this plan, please sign the copy in the project files, and bring a copy of the plan with you to the Site.

Site Name: Skillman Street Former Holder Station

Investigation: Site Management Plan (SMP) General HASP

GEI Project No: 093080-1-1106

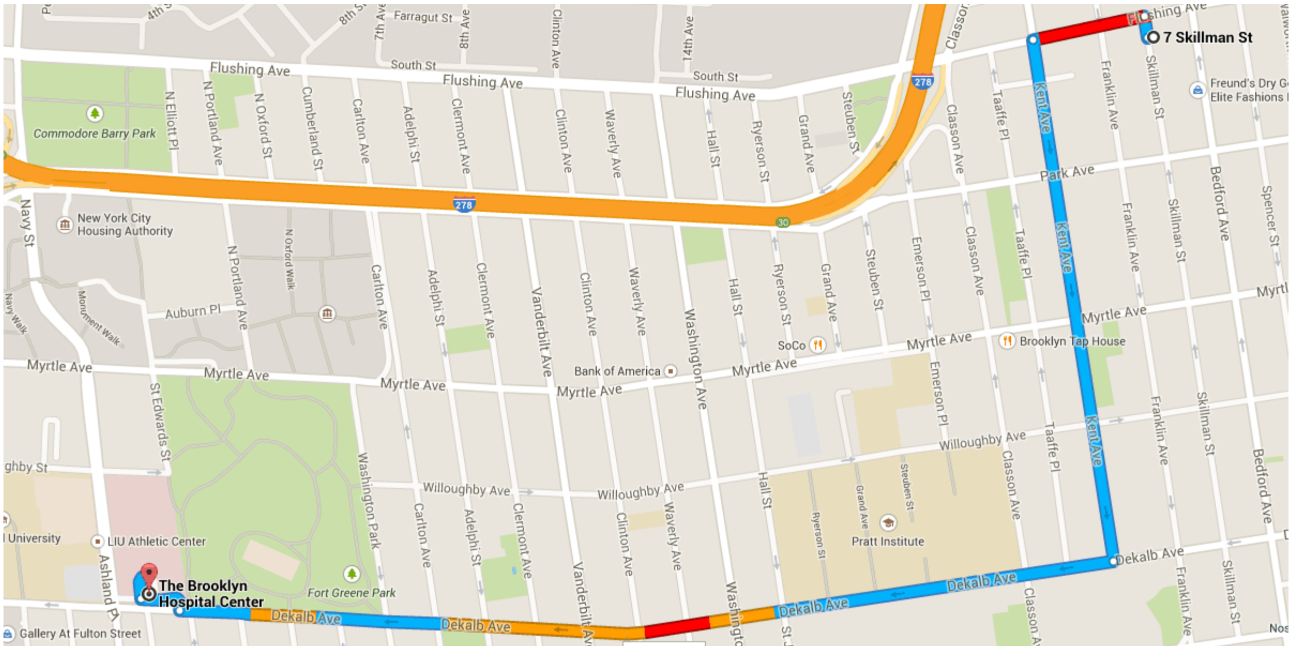
Print Name	Signature
Project Manager: Melissa Felter	

Appendix A

Map to Hospital and Occupational Health Clinic

Google

Directions from **7 Skillman St** to **The Brooklyn Hospital Center**



7 Skillman St

Brooklyn, NY 11205

1. Head **north** on **Skillman St** toward **Flushing Ave**

   121 ft

2. Turn **left** onto **Flushing Ave**

   0.1 mi

3. Turn **left** at the 2nd cross street onto **Kent Ave**

   0.6 mi

4. Turn **right** onto **Dekalb Ave**

   1.0 mi

5. Turn **right** toward **Brooklyn Hospital**

   276 ft

6. Turn **right** onto **Brooklyn Hospital**

   Destination will be on the right

   148 ft

The Brooklyn Hospital Center

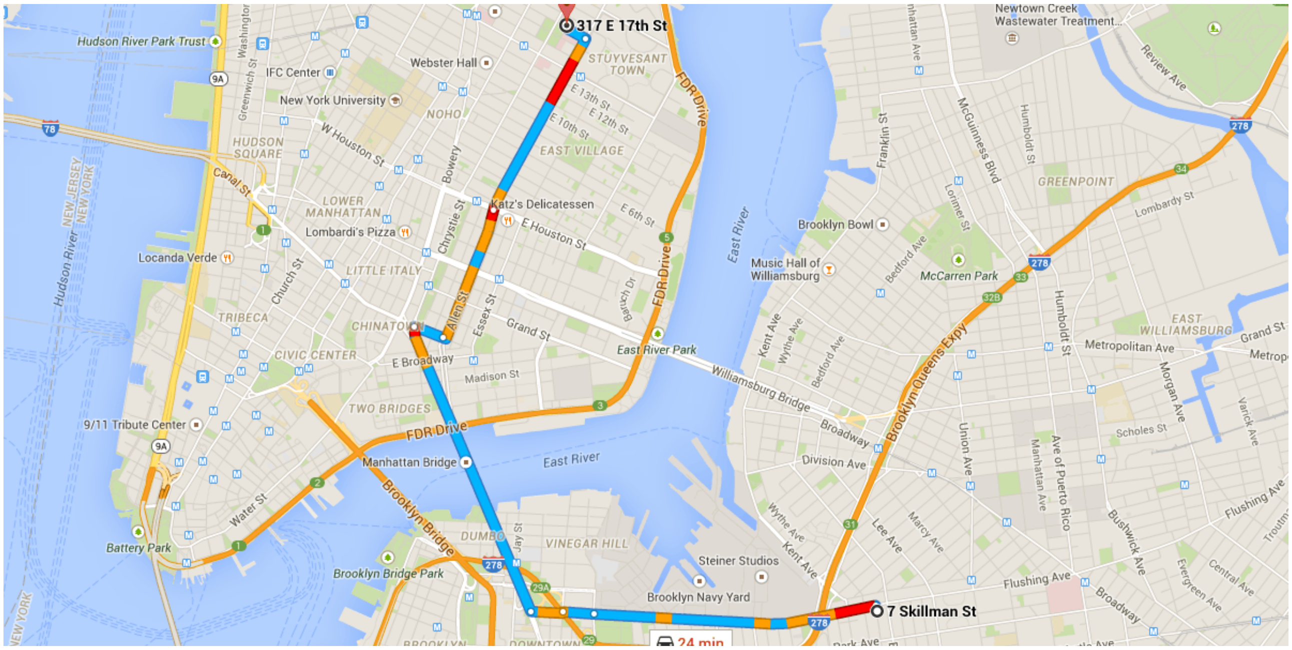
121 Dekalb Avenue, New York, NY 11201

Map data ©2015 Google

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Google

Directions from **7 Skillman St** to **317 E 17th St**

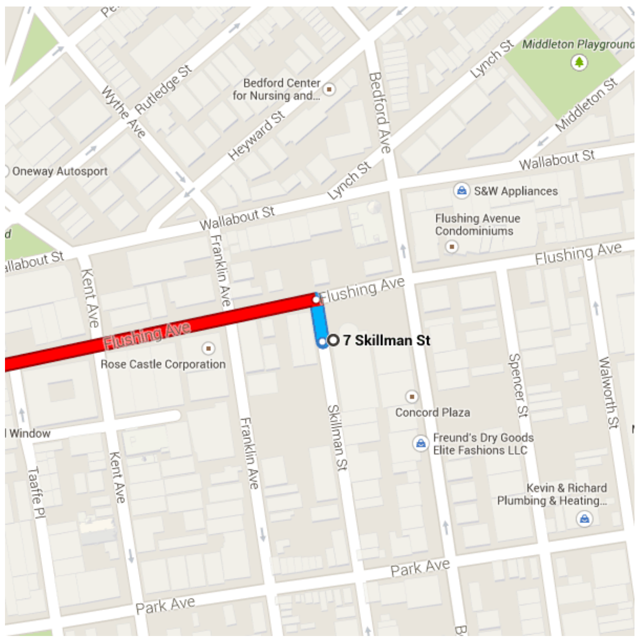


7 Skillman St

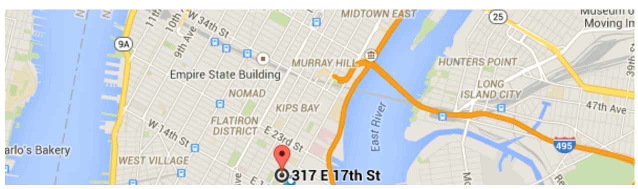
Brooklyn, NY 11205

Head **north** on **Skillman St** toward **Flushing Ave**

121 ft / 6 s



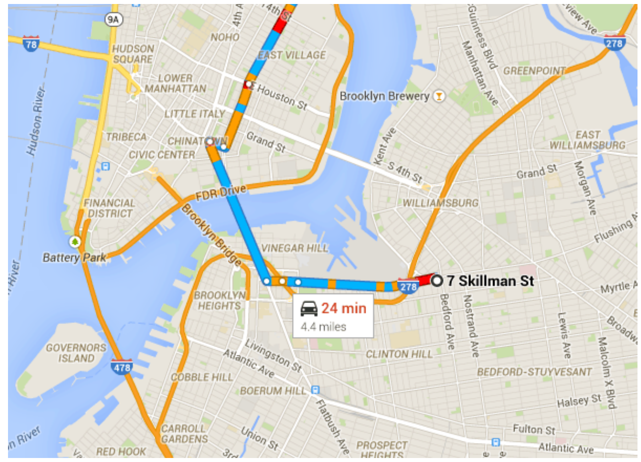
Continue on **Flushing Ave**. Take **Manhattan Bridge/Manhattan Bridge**



Map data ©2015 Google

Upper Roadway and **1st Avenue** to **E 17th St** in Manhattan

4.3 mi / 13 min



2. Turn **left** onto **Flushing Ave**

   1.2 mi

3. Continue onto **Nassau St**

   0.1 mi

4. Keep **left** to stay on **Nassau St**

   0.1 mi

5. **Nassau St** turns **right** and becomes **Manhattan Bridge/Manhattan Bridge Upper Roadway**

   1.3 mi

6. Turn **right** onto **Canal St**

   0.1 mi

7. Turn **left** onto **Allen St**

   0.6 mi

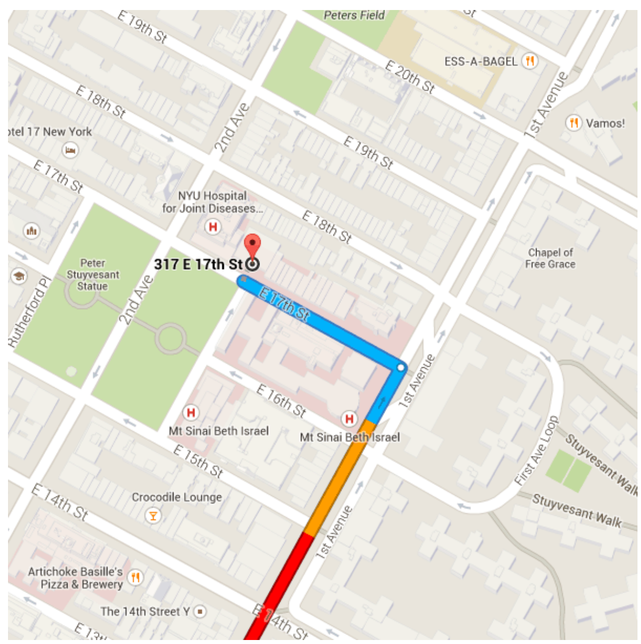
8. Continue onto **1st Avenue**

   0.8 mi

Turn **left** onto **E 17th St**

Destination will be on the right

0.1 mi / 38 s



317 E 17th St

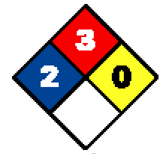
New York, NY 10003

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix B

Safety Data Sheets

HOVENSA



NFPA 704 (Section 16)

MATERIAL SAFETY DATA SHEET

Benzene **MSDS No. 0166**

1. CHEMICAL PRODUCT and COMPANY INFORMATION (rev. Jan-99)

HOVENSA L.L.C.
1 Estate Hope
Christiansted, VI 00820-5652

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800) 424-9300**
COMPANY CONTACT (business hours): **Safety Department (340) 692-3000**

SYNONYMS: Benzol; Coal Naphtha; coal tar naphtha; Cyclohexatriene; Phenyl hydride
See Section 16 for Abbreviations and Acronyms.

2. COMPOSITION and INFORMATION ON INGREDIENTS (rev. Apr-98)

INGREDIENT NAME	EXPOSURE LIMITS		CONCENTRATION PERCENT BY WEIGHT
Benzene CAS NUMBER: 71-43-2	OSHA PEL-TWA/STEL: ACGIH TLV-TWA: US Coast Guard:	1 / 5 ppm 0.5 / 2.5 ppm, A1, skin same as OSHA	100

3. HAZARDS IDENTIFICATION (rev. Apr-98; Tox-98)

EMERGENCY OVERVIEW
DANGER!
FLAMMABLE - BLOOD TOXIN AND CARCINOGEN - ABSORBED THROUGH THE SKIN - CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause blood disease, including anemia and leukemia.

EYES
Moderate to severe irritant. Contact with liquid or vapor may cause irritation.

SKIN
Moderate to severe irritant. May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION
The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION
Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

Effects to the blood (including decreased platelet and white blood cell counts), cardiovascular system, nervous system, retina, lungs, gastrointestinal system, spleen, and kidneys have been reported from large, acute (short) and repeated or prolonged exposures.

CHRONIC EFFECTS and CARCINOGENICITY
Benzene is a regulated human carcinogen. Benzene has the potential to cause bone marrow depression, aplastic anemia (low red blood cell count) and other blood diseases, including leukemia, after repeated and prolonged exposure. Benzene can cause liver and kidney toxicity.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE
Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Pre-existing chronic respiratory disease, liver or kidney dysfunction, or blood, cardiovascular and central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES (rev. Apr-98)

EYES
In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN
Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION
DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION
Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

NOTE TO PHYSICIAN
OSHA and US Coast Guard require that a person exposed to benzene in an emergency have a urine sample taken at the end of the shift and have a urine phenol test performed within 72 hours. For results equal to or greater than 75 ml/L of urine, employees must have a complete blood count every month for three months after the emergency exposure. See OSHA 29 CFR 1910.1028 or USCG 49 CFR 193.

5. FIRE FIGHTING MEASURES (rev. Jan-99)

FLAMMABLE PROPERTIES:

FLASH POINT:	12 ^{o}F (-11^{o}C)
AUTOIGNITION TEMPERATURE:	928 ^{o}F (498 ^{o}C)
OSHA/NFPA FLAMMABILITY CLASS:	1B (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.3%
UPPER EXPLOSIVE LIMIT (%):	7.9%

FIRE AND EXPLOSION HAZARDS
Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA
SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS
Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES (rev. Apr-98)

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal - caution, flammable vapors may accumulate in closed containers. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE (rev. Apr-98)

HANDLING PRECAUTIONS
Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS
Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES
Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION (rev. Apr-98)

ENGINEERING CONTROLS
Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION
Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION
Gloves constructed of Viton are recommended for heavy exposure; Viton, nitrile, PVC, or neoprene for intermittent exposure. Chemical protective clothing such as DuPont Barricade ® or equivalent recommended based on degree of exposure.

Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION
A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection and limitations.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES (rev. Mar-95)

APPEARANCE
A clear, water-like liquid

ODOR
A sweet, aromatic odor.

ODOR THRESHOLD
4.7 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE:	176 °F (80 °C)
VAPOR PRESSURE:	74.6 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1):	2.8
SPECIFIC GRAVITY (H_2O = 1):	0.87
EVAPORATION RATE:	High
PERCENT VOLATILES:	100 %
SOLUBILITY (H_2O):	Insoluble to slightly soluble

10. STABILITY and REACTIVITY (rev. Mar-95)

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS
Material is stable under normal conditions. Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

HAZARDOUS DECOMPOSITION PRODUCTS
Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES (rev. Apr-98; Tox-98)

ACUTE TOXICITY
Acute Dermal LD50 (rabbits): > 9.4 ml/kg
Acute Oral LD50 (mouse): 4.7 g/kg
Acute inhalation LC50: 10,000 ppm (rat; 7 hours)
Eye irritation (rabbit): mild to moderate
Primary dermal irritation (rabbits): mild to moderate

CHRONIC EFFECTS AND CARCINOGENICITY
Carcinogenicity: OSHA: YES IARC: (1) NTP: YES ACGIH: (A1)

Numerous epidemiological (human) and animal studies have reported an increased incidence or a causal relationship between leukemia and benzene exposure.

Mutagenicity: positive

12. ECOLOGICAL INFORMATION (rev. Apr-98)

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS (rev. Apr-98)

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION (rev. Apr-98)

DOT PROPER SHIPPING NAME:	Benzene
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1114
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

15. REGULATORY INFORMATION (rev. Apr-98)

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION
This product and its constituents listed herein are on the EPA TSCA Inventory. Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other federal, state, or local regulations; consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)
Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) or, if not practical, the U.S. Coast Guard with follow-up to the National Response Center, as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)
Benzene is a CERCLA Section 103 "hazardous substance" subject to CERCLA and SARA Section 304 reporting requirements.

Reportable Quantity: 10 pounds

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

INGREDIENT NAME (CAS NUMBER)	CONCENTRATION WT. PERCENT
Benzene (71-43-2)	100

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B, Division 2 (Flammable Liquid)
Class D, Division 2A (Very toxic by other means) and Class D, Division 2B (Toxic by other means)

16. OTHER INFORMATION (rev. Apr-98)

NFPA® HAZARD RATING	HEALTH:	2	Moderate
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
HMIS® HAZARD RATING	HEALTH:	3 *	Serious
	FIRE:	3	Serious
	REACTIVITY:	0	Minimal
			* Chronic

SUPERSEDES MSDS DATED: 04/23/98

ABBREVIATIONS:

AP = Approximately	< = Less than	> = Greater than
N/A = Not Applicable	N/D = Not Determined	ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General Info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617) 770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Workplace Hazardous Materials Information System (Canada)

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Material Safety Data Sheet

HYDROGEN SULFIDE

August 31, 1995

PHILLIPS 66 COMPANY
A Division of Phillips Petroleum Company
Bartlesville, Oklahoma 74004

PHONE NUMBERS
Emergency: (918) 661-8118
General MSDS Information: (918) 661-8327
For Additional MSDSs: (918) 661-5952

A. Product Identification

Synonyms: Sulfuretted Hydrogen; Hepatic Gas; Hydrosulfuric Acid
Chemical Name: Hydrogen Sulfide
Chemical Family: Inorganic Acid
Chemical Formula: H2S
CAS Reg. No.: 7783-06-4
Product No.: Not Established

Product and/or Components Entered on EPA's TSCA Inventory: YES

This product is in U.S. commerce, and is listed in the Toxic Substances Control Act (TSCA) Inventory of Chemicals; hence, it may be subject to applicable TSCA provisions and restrictions.

B. Hazardous Components

Ingredients	CAS Number	% By Wt.	OSHA PEL	ACGIH TLV
Hydrogen Sulfide	7783-06-4	100	10 ppm	10 ppm@

@ Short term exposure limit is 15 ppm.

C. Personal Protection Information

Ventilation: Use adequate ventilation to control exposure below recommended levels.

Respiratory Protection: For concentrations exceeding the recommended exposure level, use NIOSH/MSHA approved air purifying respirator. If conditions immediately dangerous to life or health (IDLH) exist, use NIOSH/MSHA approved self-contained breathing apparatus (SCBA) equipment.

Eye Protection: For splash protection use chemical goggles and face shield.

Skin Protection: Gloves and coveralls of rubber or neoprene construction if liquid contact could occur. Avoid unnecessary skin contamination with material.

NOTE: Personal protection information shown in Section C is based upon general information as to normal uses and conditions. Where special or unusual uses or conditions exist, it is suggested that the expert assistance of an industrial hygienist or other qualified professional be sought.

D. Handling and Storage Precautions

Proper personal protective equipment must be used when handling this chemical.

Do not get liquefied gas into eyes, on skin, or on clothing. May cause freeze burns upon direct contact. Do not breathe vapor, mist, fume or dust. May be harmful. Launder contaminated clothing before reuse. Use only with adequate ventilation. Wash thoroughly after handling.

Keep away from heat, sparks, and flames. Secure container to prevent damage. Store in a well-ventilated area. Store in tightly closed container. Bond and ground during transfer. Do not puncture or incinerate container.

Handle cylinders with care. Protect cylinders from physical damage. Containers should not be subjected to temperatures above 125F. Do not heat cylinders by any means to increase the product discharge rate. Use a check valve or trap in the discharge line to prevent backflows into the cylinders. All electrical equipment should be non-sparking or explosion proof. Test atmosphere periodically for H2S. Do not rely on sense of smell for H2S release. Use product in a closed system.

E. Reactivity Data

Stability: Stable
Conditions to Avoid: Heat, flame, or other sources of ignition.
Incompatibility (Materials to Avoid): Concentrated nitric acid, sulfuric acid, and other strong oxidizers. Vapors will combust spontaneously when mixed with chlorine, nitrogen trifluoride, or oxygen trifluoride vapors. Distinct hydrogen sulfide odor can be masked by high concentrations of vapors or gas of other chemicals.

Hazardous Polymerization: Will Not Occur
Conditions to Avoid: Not Applicable
Hazardous Decomposition Products: Sulfur Oxides formed when burned.

F. Health Hazard Data

Recommended Exposure Limits:

See Section B.

Acute Effects of Overexposure:

Eye: May be irritating to eyes at levels near the permissible exposure limit. Liquid may cause freeze burns.

Skin: Gas not expected to be irritating to skin. Liquid may cause freeze burns, irritation, reddening or swelling.

Inhalation: Toxic by inhalation. Release of liquefied product may create atmospheres which can rapidly exceed lethal levels. Acute low level exposure that exceeds the permissible exposure limit will result in irritation of the nose and throat, headache, dizziness, nausea, and nervousness.

Ingestion: Liquid may cause freeze burns and death.

Subchronic and Chronic Effects of Overexposure:

Humans breathing up to 8 ppm of hydrogen sulfide over a two month period experienced nausea, headache, shortness of breath, sleep disturbance, eye and throat irritation.

Other Health Effects:

The odor of hydrogen sulfide may not be recognized after prolonged inhalation due to paralysis of the sense of smell. Effects from inhaling the fumes may lead to chronic bronchitis, respiratory irritation, increased loss of pulmonary function, and tearing of the eyes.

Health Hazard Categories:

	Animal	Human		Animal	Human
Known Carcinogen	___	___	Toxic	_X_	_X_
Suspect Carcinogen	___	___	Corrosive	___	___
Mutagen	___	___	Irritant	___	___
Teratogen	___	___	Target Organ Toxin	_X_	_X_
Allergic Sensitizer	___	___	Specify - Skin & Eye Hazard - Freeze burns;		
Highly Toxic	___	___	Lung Hazard-Irritant; Nerve Toxin		

First Aid and Emergency Procedures:

NOTE: For freeze burns, immediately flush effected area with tap water for at least fifteen minutes, seek immediate medical attention.

Eye: Flush eyes with running water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Skin: Wash skin with soap and water for at least fifteen minutes. If irritation or adverse symptoms develop, seek medical attention.

Inhalation: Immediately remove from exposure. If breathing is difficult, give oxygen. If breathing ceases, administer artificial respiration followed by oxygen. Seek immediate medical attention.

Ingestion: If illness or adverse symptoms develop, seek medical attention.

Prompt medical attention is mandatory in all cases of overexposure to hydrogen sulfide. Rescue personnel should be equipped with NIOSH/MSHA approved self-contained breathing apparatus (SCBA). Rescue personnel should recognize the hazards of overexposure due to olfactory fatigue. The use of rescue equipment which might contain ignition sources or cause static discharges should be avoided.

Nitrite treatment as medical therapy has been used in persons overexposed to hydrogen sulfide, but the benefits of this treatment are still considered by some to be of questionable usefulness.

Therapy can only be undertaken by qualified emergency medical personnel.

Treatment should be initiated with inhalation of amyl nitrite for fifteen to thirty seconds of each minute until 10 ml of a 3% solution of sodium nitrite can be injected intravenously at a rate of 2.5 to 5 ml per minute. Sodium nitrite injections may be repeated if necessary.

G. Physical Data

Appearance:	Colorless Gas or Liquefied Gas
Odor:	Repulsive (rotten egg) Odor
Boiling Point:	-75F (-60C)
Vapor Pressure:	394.0 psia @ 100F (37.8C)
Vapor Density (Air = 1):	1.176 @ 60F (15.6C)(Calculated)
Solubility in Water:	Slight
Specific Gravity (H2O = 1):	0.79 @ 60F (15.6C) Saturation Pressure
Percent Volatile by Volume:	100
Evaporation Rate (Ethyl Ether = 1):	>1
Viscosity:	Not Applicable

H. Fire and Explosion Data

Flash Point (Method Used):	Flammable Gas
Flammable Limits (% by Volume in Air):	LEL - 4 UEL - 44
Fire Extinguishing Media:	Dry chemical, foam or carbon dioxide (CO2)
Special Fire Fighting Procedures:	Shut off source, if possible. Water for or spray may be used to cool exposed containers and equipment. Use NIOSH/MSHA approved self-contained breathing apparatus. Wear protective equipment and/or garments described in Section C.
Fire and Explosion Hazards:	Sulfur oxides formed when burned. Vapors are heavier than air and may travel to an ignition source and flashback. Autoignition temperature is 500F (260C).

I. Spill, Leak and Disposal Procedures

Precautions Required if Material is Released or Spilled:
Evacuate area of all unnecessary personnel. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. Shut off source. Ventilate confined area.

Waste Disposal (Insure Conformity with all Applicable Disposal Regulations):
Incinerate or place in permitted waste management facility.

J. DOT Transportation

Shipping Name:	Hydrogen sulfide, liquefied
Hazard Class:	2.3 (Poisonous gas)
ID Number:	UN 1053

```
        Packing Group: Not applicable
              Marking: Hydrogen Sulfide, liquefied, UN1053, RQ* Inhalation
                       hazard
                Label: Poison gas and Flammable gas
              Placard: Poisonous gas/1053
Hazardous Substance/RQ: Hydrogen sulfide/100#
  Shipping Description: Hydrogen sulfide, liquefied, 2.3 (Poisonous gas),
                       UN 1053, RQ*, Poison - Inhalation Hazard Zone B
  Packaging References: 49 CFR 173.304, 173.314, 173.315
```

* Enter the letters "RQ" as shown only if the hazardous substance is present in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) shown for the hazardous substance.

K. RCRA Classification - Unadulterated Product as a Waste

Ignitable (D001); Hydrogen Sulfide (U135)

Prior to disposal, consult your environmental contact to determine if the TCLP (Toxicity Characteristic Leaching Procedure, EPA Test Method 1311) is required. Reference 40 CFR Part 261.

L. Protection Required for Work on Contaminated Equipment

Contact immediate supervisor for specific instructions before work is initiated. Wear protective equipment and/or garments described in Section C if exposure conditions warrant. If repair of user's equipment is required, purge equipment with an inert gas prior to repairing.

M. Hazard Classification

_X_ This product meets the following hazard definition(s) as defined by the Occupational Safety and Health Hazard Communication Standard (29 CFR Section 1910.1200):

```
___ Combustible Liquid    ___ Flammable Aerosol          ___ Oxidizer
_X_ Compressed Gas        ___ Explosive                  ___ Pyrophoric
_X_ Flammable Gas         _X_ Health Hazard (Section F)  ___ Unstable
___ Flammable Liquid      ___ Organic Peroxide           ___ Water Reactive
___ Flammable Solid
```

___ Based on information presently available, this product does not meet any of the hazard definitions of 29 CFR Section 1910.1200.

N. Additional Comments

As of the preparation date, this product did not contain a chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

```
NFPA 704 Hazard Codes - - - - - - - - Signals

                                  Least - 0
   Health      : 3                Slight - 1
   Flammability: 4                Moderate - 2
```

```
Reactivity  : 0                    High - 3
Special Haz.: -                    Extreme - 4
```

Material Safety Data Sheet
Phenol Liquid

Section 1 - Chemical Product and Company Identification

MSDS Name: Phenol Liquid
Catalog Numbers: A88I-500, A931I-1, A931I-200, A931I-4, A931I-500, S801181, S801181MF
Synonyms: Phenylic acid
Company Identification:
Fisher Scientific
1 Reagent Lane
Fair Lawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
108-95-2	Phenol	89	203-632-7
7732-18-5	Water	11	231-791-2

Hazard Symbols: T
Risk Phrases: 34 24/25

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: colorless liquid. Flash Point: 175 deg F. **Danger!** Corrosive. **Combustible liquid and vapor.** Toxic. Harmful if swallowed, inhaled, or absorbed through the skin. May cause severe respiratory and digestive tract irritation with possible burns. Causes severe eye and skin burns. May cause liver and kidney damage. May cause reproductive and fetal effects. Eye contact may result in permanent eye damage. May cause central nervous system effects.
Target Organs: Kidneys, central nervous system, liver.

Potential Health Effects

Eye: Contact with liquid or vapor causes severe burns and possible irreversible eye damage.
Skin: Causes severe skin irritation. Harmful if absorbed through the skin. Direct skin contact results in white, wrinkled discoloration, followed by severe burns. Phenol solutions may be absorbed through the skin ra pidly to cause systemic poisoning and possible death.
Ingestion: Symptoms may include: headache, excitement, fatigue, nausea, vomiting, stupor, and coma. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure. Causes digestive tract burns with immediate pain, swelling of the throat, convulsions, and possible coma.
Inhalation: Causes severe irritation of upper respiratory tract with coughing, burns, breathing difficulty, and possible coma. May be fatal if exposed to high concentrations. May also cause pallor, loss of appetite, nausea, vomiting, diarrhea, weakness, darkened urine, headache, sweating, convulsions, cyanosis (bluish skin due to deficient oxygenation of the blood), unconsciousness, fatigue, pulmonary edema & coma.
Chronic: Chronic inhalation and ingestion may cause effects similar to those of acute inhalation and ingestion. May cause liver and kidney damage. May cause fetal effects. Repeated skin contact may cause dermatitis with dark pigmentation of the skin.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.
Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes

while removing contaminated clothing and shoes. Discard contaminated clothing in a manner which limits further exposure. SPEEDY ACTION IS CRITICAL! Destroy contaminated shoes.
Ingestion: Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: Vapors may form an explosive mixture with air. Use water spray to keep fire-exposed containers cool. Wear appropriate protective clothing to prevent contact with skin and eyes. Wear a self-contained breathing apparatus (SCBA) to prevent contact with thermal decomposition products.
Extinguishing Media: For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam.
Flash Point: 175e deg F (79.44 deg C)
Autoignition Temperature: 1319 deg F (715.00 deg C)
Explosion Limits, Lower:1.8
Upper: 8.6
NFPA Rating: (estimated) Health: 4; Flammability: 2; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Do not get in eyes, on skin, or on clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Do not ingest or inhale. Use only in a chemical fume hood. Wash clothing before reuse. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames.
Storage: Keep away from heat and flame. Keep away from sources of ignition. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Phenol	5 ppm TWA; skin - potential for cutaneous absorption	5 ppm TWA; 19 mg/m3 TWA 250 ppm IDLH	5 ppm TWA; 19 mg/m3 TWA
Water	none listed	none listed	none listed

OSHA Vacated PELs: Phenol: 5 ppm TWA; 19 mg/m3 TWA Water: No OSHA Vacated PELs are listed for this chemical.
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear neoprene gloves, apron, and/or clothing. Selection of specific glove materials should be based on your conditions of use in your application in consultation with your Safety Officer and manufacturer's glove recommendations.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: colorless

Odor: sweetish odor
pH: 6 aqueous solution.
Vapor Pressure: .35 mm Hg @25C
Vapor Density: 3.2
Evaporation Rate:<0.01 (butyl acetate=1)
Viscosity: 1.51 cp@80C
Boiling Point: 360 deg F
Freezing/Melting Point:109 deg F
Decomposition Temperature: Not available.
Solubility: 6.75% in water
Specific Gravity/Density:1.0576
Molecular Formula:H6H6O
Molecular Weight:28.0834

Section 10 - Stability and Reactivity

Chemical Stability: Stable.
Conditions to Avoid: Temperatures above recommended temperatures.
Incompatibilities with Other Materials: Incompatible with strong oxidizing agents, alkalies, nitric acid, calcium hypochlorite, and halogens, Mixture with nitrobenzene and aluminum chloride may violently explode. Coagulates colodion and proteins. Hot liquid phenol will attack aluminum, magnesium, lead, and zinc metals. Mixtures with nitrobenzene and aluminum chloride may violently explode.
Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:
CAS# 108-95-2: SJ3325000
CAS# 7732-18-5: ZC0110000
LD50/LC50:
CAS# 108-95-2:
Draize test, rabbit, eye: 5 mg Severe;
Draize test, rabbit, skin: 500 mg/24H Severe;
Draize test, rabbit, skin: 100 mg Mild;
Inhalation, mouse: LC50 = 177 mg/m3;
Inhalation, rat: LC50 = 316 mg/m3;
Oral, mouse: LD50 = 270 mg/kg;
Oral, rat: LD50 = 317 mg/kg;
Skin, rabbit: LD50 = 630 mg/kg;
Skin, rat: LD50 = 669 mg/kg;
CAS# 7732-18-5:
Oral, rat: LD50 = >90 mL/kg;
Carcinogenicity:
CAS# 108-95-2:
ACGIH: A4 - Not Classifiable as a Human Carcinogen
IARC: IARC Group 3 - not classifiable CAS# 7732-18-5: Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology: The IARC has determined that there is inadequate evidence fo r carcinogenicity of phenol in humans and experiment aal animals.
Teratogenicity: No information available.
Reproductive Effects: No information available.
Neurotoxicity: No information available.
Mutagenicity: No information available.
Other Studies: Rabbit skin irritation: severe. Rabbit eye irritation: sever e.

Section 12 - Ecological Information

Ecotoxicity: Daphnia: EC50=4.0mg/l; 96hour; ia: EC50=12.0mg/l; 48 hour; No data
Environmental: Will not be expected to significantly bioconcentrate in aquatic organisms.
Physical: In water, phenol will not be expected to significantly hydrolyze.
Other: 96-hour LC50=11 mg/l in Gammarus fasciatus. 48-hour LC=11.2 mg/l in Leuciscus idus.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 108-95-2: waste number U188.

Section 14 - Transport Information

	US DOT	IATA	RID/ADR	IMO	Canada TDG
Shipping Name:	PHENOL SOLUTIONS				PHENOL SOLUTION
Hazard Class:	6.1				6.1(9.2)
UN Number:	UN2821				UN2821
Packing Group:	II				II

Section 15 - Regulatory Information

US FEDERAL
TSCA
CAS# 108-95-2 is listed on the TSCA inventory.
CAS# 7732-18-5 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 108-95-2: Effective Date: 6/1/87; Sunset Date: 6/1/97
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
CERCLA Hazardous Substances and corresponding RQs
CAS# 108-95-2: 1000 lb final RQ; 454 kg final RQ
SARA Section 302 Extremely Hazardous Substances
CAS# 108-95-2: 500 lb TPQ (lower threshold); 10,000 lb TPQ (upper thre shold)
SARA Codes
CAS # 108-95-2: acute, chronic, flammable.
Section 313
This material contains Phenol (CAS# 108-95-2, 89%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.
Clean Air Act:
CAS# 108-95-2 is listed as a hazardous air pollutant (HAP). This material does not contain any Class 1 Ozone depletors. This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 108-95-2 is listed as a Hazardous Substance under the CWA. CAS# 108-95-2 is listed as a Priority Pollutant under the Clean Water Act. CAS# 108-95-2 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
CAS# 108-95-2 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
CAS# 7732-18-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.
California No Significant Risk Level: None of the chemicals in this product are listed.
European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols:
T
Risk Phrases:
R 34 Causes burns.
R 24/25 Toxic in contact with skin and if swallowed.
Safety Phrases:

S 28 After contact with skin, wash immediately with...
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)
CAS# 108-95-2: 2
CAS# 7732-18-5: No information available.

Canada - DSL/NDSL
CAS# 108-95-2 is listed on Canada's DSL List.
CAS# 7732-18-5 is listed on Canada's DSL List.

Canada - WHMIS
This product has a WHMIS classification of B3, D1A, E.

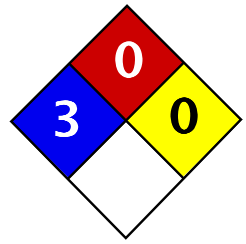
Canadian Ingredient Disclosure List
CAS# 108-95-2 is listed on the Canadian Ingredient Disclosure List.

Exposure Limits
CAS# 108-95-2: OEL-ARAB Republic of Egypt:TWA 5 ppm (19 mg/m3);Skin OEL-AUSTRALIA:TWA 5 ppm (19 mg/m3);Skin OEL-BELGIUM:TWA 5 ppm (19 mg/m3);Skin OEL-CZECHOSLOVAKIA:TWA 20 mg/m3;STEL 40 mg/m3 OEL-DENMARK:TWA 5 ppm (19 mg/m3);Skin OEL-FINLAND:TWA 5 ppm (19 mg/m3);STEL 10 ppm (38 mg/m3);Skin OEL-FRANCE:TWA 5 ppm (19 mg/m3);Skin OEL-GERMANY:TWA 5 ppm (19 mg/m3);Skin OEL-HUNGARY:TWA 4 mg/m3;STEL 8 mg/m3;Skin OEL-JAPAN:TWA 5 ppm (19 mg/m3);Skin OEL-THE NETHERLANDS:TWA 5 ppm (19 mg/m3);Skin OEL-THE PHILIPPINES:TWA 5 ppm (10 mg/m3);Skin OEL-POLAND:TWA 10 ppm OEL-RUSSIA:TWA 5 ppm;STEL 0.3 mg/m3;Skin OEL-SWEDEN:TWA 1 ppm (4 mg/m3);STEL 2 ppm (8 mg/m3);Skin OEL-SWITZERLAND:TWA 5 ppm (19 mg/m3);STEL 10 ppm (38 mg/m3);Skin OEL-THAILAND:TWA 5 ppm (19 mg/m3) OEL-TURKEY:TWA 5 ppm (19 mg/m3);Skin OEL-UNITED KINGDOM:TWA 5 ppm (19 mg/m3);STEL 10 ppm;Skin OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

Section 16 - Additional Information

MSDS Creation Date: 6/01/1999
Revision #5 Date: 10/08/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



Health	3
Fire	1
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
Sodium Cyanide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium Cyanide

Catalog Codes: SLS2314, SLS3736

CAS#: 143-33-9

RTECS: VZ7525000

TSCA: TSCA 8(b) inventory: Sodium Cyanide

CI#: Not available.

Synonym:

Chemical Name: Sodium Cyanide

Chemical Formula: NaCN

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium Cyanide	143-33-9	100

Toxicological Data on Ingredients: Sodium Cyanide: ORAL (LD50): Acute: 6.44 mg/kg [Rat]. DERMAL (LD50): Acute: 10.4 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (permeator). Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.

The substance may be toxic to skin, eyes, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

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

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

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

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

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

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Slightly flammable to flammable in presence of acids, of moisture.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:
Dangerous on contact with acids, acid fumes, water or stream. It will produce toxic and flammable vapors of CN-H and sodium oxide.
Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas.
When heated to decomposition it emits toxic fumes hydgrogen cyanide and oxides of nitrogen

Special Remarks on Explosion Hazards: Fusion mixtures of metal cyanides with metal chlorates, perchlorated or nitrates causes a violent explosion

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:
Corrosive solid. Poisonous solid.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 24°C (75.2°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

Exposure Limits:
STEL: 5 (mg/m3) from ACGIH (TLV) [United States] SKIN
CEIL: 4.7 from NIOSH
CEIL: 5 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Granular solid. Flakes solid.)

Odor:
Faint almond-like odor.
Odorless when perfectly dry. Emits odor of
hydrogen cyanide when damp.

Taste: Not available.

Molecular Weight: 49.01 g/mole

Color: White.

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

Boiling Point: 1496°C (2724.8°F)

Melting Point: 563°C (1045.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.595 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Vapor Density of Hydrogen Cyanide gas: 0.941

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility:
Soluble in cold water.
Slightly soluble in Ethanol

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, moisture, incompatibles.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity:
Corrosive in presence of aluminum.
Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Violent reaction with fluorine gas, magnesium, nitrates, nitric acid.
Dangerous on contact with acids, acid fumes, water or stream. It wil produce toxic and flammable vapors of CN-H and sodium oxide.
Cyanide may react with CO_2 in ordinary air to form toxic hydrogen cyanide gas.
Strong oxidizers such as acids, acid salts, chlorates, and nitrates.
Contact with acids and acid salts causes immediate formation of toxic and flammable hydrogen cyanide gas.

Special Remarks on Corrosivity: Corrosive to aluminum

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
Acute oral toxicity (LD50): 6.44 mg/kg [Rat].
Acute dermal toxicity (LD50): 10.4 mg/kg [Rabbit].

Chronic Effects on Humans: May cause damage to the following organs: skin, eyes, central nervous system (CNS).

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May cause adverse reproductive effects (maternal and paternal fertility) based on animal data.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health effects:
Skin: May cause itching and irritation. May be fatal if absorbed through injured skin with symtpoms similar to those noted for inhalation and ingestion.
Eyes: May cause eye irritation and eye damage.
Inhalation: May cause respiratory tract irritation. May be fatal if inhaled. The substance inhibits cellular respiration causing metabolic asphyxiation. May cause headache, weakness, dizziness, labored breathing, nausea, vomiting. May be followed by cardiovascular effects, unconciousness, convulsions, coma, and death
Ingestion: May be fatal if swallowed. May cause gastrointestinal tract irritation with nausea, vomiting. May affect behavior and nervous systems(seizures, convulsions, change in motor activity, headache, dizziness, confusion, weakness stupor, aniexity, agitation, tremors), cardiovascular system, respiration (hyperventilation, pulmonary edema, breathing difficulty, respiratory failure), cardiovascular system (palpitations, rapid heart beat, hypertension, hypotension). Massive doses by produce sudden loss of conciousness and prompt death from respiratory arrest.
Smaller but still lethal doses
on the breath or vomitus.
Chronic Potential Health Effects:
Central Nervous system effects (headaches, vertigo, insomnia, memory loss, tremors, fatigue), fatigue, metabolic effects (poor appetite), cardiovascular effects (chest discomfort, palpitations), nerve damage to the eyes, or dermatitis, respiratory tract irritation, eye irritation, or death can occur.
may prolong the illness for 1 or more hours. A bitter almond odor may be noted

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Sodium cyanide UNNA: 1689 PG: I

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut carcinogen reporting list.: Sodium Cyanide
Illinois chemical safety act: Sodium Cyanide
New York release reporting list: Sodium Cyanide
Rhode Island RTK hazardous substances: Sodium Cyanide
Pennsylvania RTK: Sodium Cyanide
Minnesota: Sodium Cyanide
Massachusetts RTK: Sodium Cyanide
Massachusetts spill list: Sodium Cyanide
New Jersey: Sodium Cyanide
New Jersey spill list: Sodium Cyanide
Louisiana RTK reporting list: Sodium Cyanide
Louisiana spill reporting: Sodium Cyanide
California Director's List of Hazardous Substances: Sodium Cyanide
TSCA 8(b) inventory: Sodium Cyanide
TSCA 4(a) final test rules: Sodium Cyanide
TSCA 8(a) PAIR: Sodium Cyanide
TSCA 8(d) H and S data reporting: Sodium Cyanide
TSCA 12(b) one time export: Sodium Cyanide
SARA 302/304/311/312 extremely hazardous substances: Sodium Cyanide
CERCLA: Hazardous substances.: Sodium Cyanide: 10 lbs. (4.536 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-6: Reactive and very flammable material.
CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).
CLASS E: Corrosive solid.

DSCL (EEC):
R27/28- Very toxic in contact with skin and if swallowed.
R41- Risk of serious damage to eyes.
S1/2- Keep locked up and out of the reach of children.
S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S28- After contact with skin, wash immediately

with plenty of water
S36/37- Wear suitable protective clothing and gloves.
S39- Wear eye/face protection.
S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S46- If swallowed, seek medical advice immediately and show this container or label.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Synthetic apron.
Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:58 PM

Last Updated: 11/06/2008 12:00 PM

SPI Supplies Division
Structure Probe, Inc.
P.O. Box 656 West Chester, PA 19381-0656 USA
Phone: 1-(610)-436-5400 Fax: 1-(610)-436-5755
E-mail: spi3spi@2spi.com
WWW: http://www.2spi.com
Manufacturer's CAGE: 1P573

Material Safety Data Sheet

SPI #02701-AB, 02701A-AB Chrysotile "B" and SPI #02740-AB, 02740A-AB Chrysolile "B" Asbestos Standards

---

Section 1: Identification

```
Date Effective........... May 30, 2007
                          (most recent revision)

Chemical family..... Hydrous silicates of magnesia

Emergencies
Contacting CHEMTREC:

24 Hour Emergency Use Only #'s......
Worldwide phone: 1-(703)-527-3887
Worldwide FAX:   1-(703)-741-6090
Toll-free phone: 1-(800)-424-9300 USA only

Product or Trade Name....  Chrysotile asbestos fiber

Emergency Overview:
Chrysotile asbestos is a known human carcinogen.
```

Section 2: Composition

Name	CAS #	EC#	Approximate Weight %
Chrysotile	12001-29-5	650-013-006	>99.99%

Confirmed carcinogen by ACGIH, IARC, OSHA AND NTP.

Section 3: Hazard Identification

Potential Health Effects:
    Acute: Overexposure to breathing asbestos may cause asbestosis, pulmonary fibrosis, mesothelioma, other lung disorders or cancer. Handling of materials and smoking or eating prior to washing could be hazardous. Medical examination and x-rays are required to determine signs & symptoms of exposure.

Routes of exposure: Inhalation, Skin contact, Ingestion

Medical Conditions Aggravated by Exposure:
    Pulmonary disease

Occupational Exposure Limits:

TLV: 0.1 fiber/cc (as TWA)
A1 (ACGIH 1998. For fibers longer than 5Âµm with an aspect ratio equal to or greater than 3:1 as determined at 400-450X magnification by the membrane filter method).

Incompatibilies:
Strong oxidizers, strong acids, and bases

Route of entry: Inhalation, Skin contact, Ingestion
Target organs: Lungs

Symptoms:
There are not acute signs or symptoms associated with asbestos. Diseases associated with over exposure are chronic, generally taking from 10 to 40 years to become apparent.

Section 4: First Aid Measures

Eyes: In case of contact, immediately flush eyes with copious amounts of flowing water for at least 15 minutes, retracting eye lids often. Get medical attention immediately. Contact lenses should not be worn when working with this product.

Skin: Wash skin thoroughly with mild soap and water. Flush with copious amounts of water for 15 minutes.

Inhalation: Move the exposed person to fresh air at once. Support breathing. If symptoms persist contact physician.

Ingestion: Get medical aid immediately.

Section 5: Fire Fighting Measures

Flammability classification: Not classified.
Heat resistant up to 500°C; is completely decomposed at a temperature of 1000°C.

Flash Point/Method: Not known

Auto-Ignition Temperature: Not determined

Flammable Limits: Lower: Not applicable
Upper: Not applicable

Extinguishing Media: Water, Foam, Dry Chemical

Unusual Fire Hazards: Toxic gases and asbestos particulate may be Released in a fire.

Firefighting procedures/instructions:
Use NIOSH approved self-contained breathing apparatus and full protective equipment.
Properties that could increase fire or explosion hazard:
Combustibility of this material results from paraffin lubrication.

Section 6: Accidental Release Measures

Use HEPA vacuum wet methods when feasible. Use appropriate personal protection for clean-up personnel.

Section 7: Handling and Storage

Storage and handling:
Store in well-sealed container in cool, dry area.

Section 8: Exposure Controls and Personal Protection

ANSI approved eye wash and deluge shower should be available in the work area.

Personal Protective Equipment (PPE):

Eye/Face Protection: ANSI 87.1 approved chemical safety glasses with side shield.

Protective gloves: Rubber gloves
Protective clothing: Wear protective clothing to prevent skin contact. Do NOT take working clothes home.

Respiratory Protection:
Wear NIOSH approved respirator in accordance with 29CFR1910.1001.

Other: Wash prior to eating, drinking, or smoking. Avoid ingestion or breathing of dust.

Section 9: Physical and Chemical Properties

Appearance: white or gray fibrous solid
Color: white or gray
pH: Not applicable
Odor: None
Vapor Pressure: Not applicable
Vapor Density (Air=1): Not available
Boiling Point/Range: Not available
Melting Point/Range: Decomposes above 500°C
Specific Gravity: 2.2 to 2.6 g/cc
Solubility in water: None
Softening Point: Not determined
Molecular Formula: $Mg_3Si_2H_4O_6/Mg_3(Si_2O_5)(OH)4$
Molecular Weight: 277
%Volatile by Volume: Not determined
Evaporation Rate (n-butyl acetate = 1): Not available
Viscosity: Not available

Section 10: Stability and Reactivity

Chemical Stability: The product is stable under normal use conditions.

Conditions to Avoid:
Prevent dispersion of dust. Avoid all contact. Avoid airborne concentrations at or above OSHA PEL.

Incompatibility (materials to avoid):
Strong oxidizers, strong acids, and bases.

Hazardous Products of Decomposition:
None known

Reactions with Air and Water:
Avoid airborne concentrations at or above OSHA PEL.

Section 11: Toxicological Information

RTECS# CI3478500

Section 12: Ecological Information

None available

Section 13: Disposal Considerations

Bury waste is solid landfill as required in 29CFR1910.1001. Comply with applicable OSHA, Federal, State and Local regulations.

Section 14: Transport Information

Proper Shipping Name: White asbestos (chrysotile)

DOT Hazard Class: 9

UN/NA ID: UN2590

Packing Group: III

Labels: 9

Marine Pollutant: No information

DOT Status: Not Regulated

Section 15: Regulatory Information

United States:

TSCA
This product is listed under the TSCA Inventory.

CERCLA:
This product has an RQ of 1 pound under CERCLA.

SARA:
Section 313
This product is listed under SARA Section 313.

California Prop. 65:
Asbestos a known carcinogen under California Prop. 65.

US Statements:
Confirmed carcinogen. Target organs: Lung

European/International Regulations:
European Labeling in Accordance with EC Directives

Hazard Symbols: T Toxic
Risk Phrases:
R23 Toxic by Inhalation
R45 May cause cancer
R48 Danger of serious damage to health by prolonged exposure
R49 May cause cancer by inhalation

Safety Phrases:
S53 Avoid exposure â€“ obtain special instructions before use
S45 In case of accident, or if you feel unwell, seek medical advice immediately (show the label where possible.)

Canada

This product has a WHMIS classification of D2B.

DSL/NDSL
This product is listed on the DSL List and is not listed on the NDSL List.

Section 16: Other Information

If this product should be used in ways that are outside of the intended applications in scanning electron microscope laboratories, and if it is going to be formulated into some other system, so that it becomes just another component of that other system, read the MSDS sheets for the other components before blending as the resulting mixture may have the hazards of all of its parts.

Disclaimer of Liability:

Caution! Do not use SPI Supplies products or materials in applications involving implantation within the body; direct or indirect contact with the blood pathway; contact with bone, tissue, tissue fluid, or blood; or prolonged contact with mucous membranes. Products offered by SPI Supplies are not designed or manufactured for use in implantation in the human body or in contact with internal body fluids or tissues. SPI Supplies will not provide to customers making devices for such applications any notice, certification, or information necessary for such medical device use required by US FDA (Food and Drug Administration) regulation or any other statute.

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****

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Wednesday December 03, 2008

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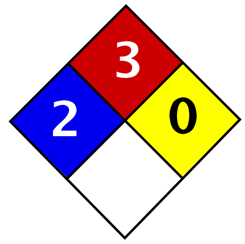


Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Ethylbenzene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Ethylbenzene

Catalog Codes: SLE2044

CAS#: 100-41-4

RTECS: DA0700000

TSCA: TSCA 8(b) inventory: Ethylbenzene

CI#: Not available.

Synonym: Ethyl Benzene; Ethylbenzol; Phenylethane

Chemical Name: Ethylbenzene

Chemical Formula: C8H10

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Ethylbenzene	100-41-4	100

Toxicological Data on Ingredients: Ethylbenzene: ORAL (LD50): Acute: 3500 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (irritant, sensitizer).
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

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

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

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

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

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 432°C (809.6°F)

Flash Points:
CLOSED CUP: 15°C (59°F). (Tagliabue.) OPEN CUP: 26.667°C (80°F) (Cleveland) (CHRIS, 2001)
CLOSED CUP: 12.8 C (55 F) (Bingham et al, 2001; NIOSH, 2001)
CLOSED CUP: 21 C (70 F) (NFPA)

Flammable Limits: LOWER: 0.8% - 1.6%UPPER: 6.7% - 7%

Products of Combustion: These products are carbon oxides (CO, CO_2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.
Slightly explosive in presence of heat.

Fire Fighting Media and Instructions:
Flammable liquid, soluble or dispersed in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards:
Vapor may travel considerable distance to source of ignition and flash back. Vapors may form explosive mixtures with air. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Vapors may form explosive mixtures in air.

Section 6: Accidental Release Measures

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

Large Spill:
Flammable liquid.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

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

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

Exposure Limits:
TWA: 100 STEL: 125 (ppm) from OSHA (PEL) [United States]
TWA: 435 STEL: 545 from OSHA (PEL) [United States]
TWA: 435 STEL: 545 (mg/m3) from NIOSH [United States]
TWA: 100 STEL: 125 (ppm) from NIOSH [United States]
TWA: 100 STEL: 125 (ppm) from ACGIH (TLV) [United States]
TWA: 100 STEL: 125 (ppm) [United Kingdom (UK)]
TWA: 100 STEL: 125 (ppm) [Belgium]
TWA: 100 STEL: 125 (ppm) [Finland]
TWA: 50 (ppm) [Norway]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweetish. Gasoline-like. Aromatic.

Taste: Not available.

Molecular Weight: 106.16 g/mole

Color: Colorless.

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

Boiling Point: 136°C (276.8°F)

Melting Point: -94.9 (-138.8°F)

Critical Temperature: 617.15°C (1142.9°F)

Specific Gravity: 0.867 (Water = 1)

Vapor Pressure: 0.9 kPa (@ 20°C)

Vapor Density: 3.66 (Air = 1)

Volatility: 100% (v/v).

Odor Threshold: 140 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 3.1

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility:
Easily soluble in diethyl ether.
Very slightly soluble in cold water or practically insoluble in water.
Soluble in all proportions in Ethyl alcohol.
Soluble in Carbon tetrachloride, Benzene.
Insoluble in Ammonia.
Slightly soluble in Chloroform.
Solubility in Water: 169 mg/l @ 25 deg. C.; 0.014 g/100 ml @ 15 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ingnition sources (flames, sparks, static), incompatible materials, light

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:
Can react vigorously with oxidizing materials.
Sensitive to light.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation.

Toxicity to Animals: Acute oral toxicity (LD50): 3500 mg/kg [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC.
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast.
May cause damage to the following organs: central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of ingestion, of inhalation.
Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals:
Lethal Dose/Conc 50% Kill:
LD50 [Rabbit] - Route: Skin; Dose: 17800 ul/kg
Lowest Published Lethal Dose/Conc:
LDL[Rat] - Route: Inhalation (vapor); Dose: 4000 ppm/4 H

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects and birth defects (teratogenic) based on animal test data.
May cause cancer based on animals data. IARC evidence for carcinogenicity in animals is sufficient. IARC evidence of carcinogenicity in humans inadequate.
May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Can cause mild skin irritation. It can be absorbed through intact skin.
Eyes: Contact with vapor or liquid can cause severe eye irritation depending on concentration. It may also cause conjunctivitis. At a vapor exposure level of 85 - 200 ppm , it is mildly and transiently irritating to the eyes; 1000 ppm causes further irritation and tearing; 2000 ppm results in immediate and severe irritation and tearing; 5,000 ppm is intolerable (ACGIH, 1991; Clayton and Clayton, 1994). Standard draize test for eye irritation using 500 mg resulted in severe irritation (RTECS)
Inhalation: Exposure to high concentrations can cause nasal, mucous membrane and respiratory tract irritation and can also result in chest constriction and, trouble breathing, respiratory failure, and even death. It can also affect behavior/Central Nervous System. The effective dose for CNS depression in experimental animals was 10,000 ppm (ACGIH, 1991). Symptoms of CNS depression include headache, nausea, weakness, dizziness, vertigo, irritability, fatigue, lightheadedness, sleepiness, tremor, loss of coordination, judgement and conciousness, coma, and death. It can also cause pulmonary edema. Inhalation of 85 ppm can produce fatigue, insomnia, headache, and mild irritation of the respiratory tract (Haley & Berndt, 1987).
Ingestion: Do not drink, pipet or siphon by mouth. May cause gastroinestinal/digestive tract irritation with Abdominal pain, nausea, vomiting. Ethylbenzene is a pulmonary aspiration hazard. Pulmonary aspiration of even small amounts of the liquid may cause fatal pneumonitis. It may also affect behavior/central nervous system with

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 14 mg/l 96 hours [Fish (Trout)] (static). 12.1 mg/l 96 hours [Fish (Fathead Minnow)] (flow-through)]. 150 mg/l 96 hours [Fish (Blue Gill/Sunfish)] (static). 275 mg/l 96 hours [Fish (Sheepshead Minnow)]. 42.3 mg/l 96 hours [Fish (Fathead Minnow)](soft water). 87.6mg/l 96 hours [Shrimp].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Ethylbenzene UNNA: 1175 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Ethylbenzene
Illinois toxic substances disclosure to employee act: Ethylbenzene
Illinois chemical safety act: Ethylbenzene
New York release reporting list: Ethylbenzene
Rhode Island RTK hazardous substances: Ethylbenzene
Pennsylvania RTK: Ethylbenzene
Minnesota: Ethylbenzene
Massachusetts RTK: Ethylbenzene
Massachusetts spill list: Ethylbenzene
New Jersey: Ethylbenzene
New Jersey spill list: Ethylbenzene
Louisiana spill reporting: Ethylbenzene
California Director's List of Hazardous Substances: Ethylbenzene
TSCA 8(b) inventory: Ethylbenzene
TSCA 4(a) proposed test rules: Ethylbenzene
TSCA 8(d) H and S data reporting: Ethylbenzene: Effective Date: 6/19/87; Sunset Date: 6/19/97
SARA 313 toxic chemical notification and release reporting: Ethylbenzene

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).
CLASSE D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S24/25- Avoid contact with skin and eyes.
S29- Do not empty into drains.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

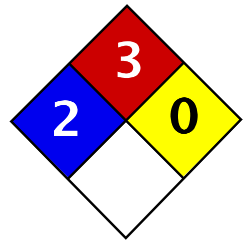
Section 16: Other Information

References:
-Manufacturer's Material Safety Data Sheet.
-Fire Protection Guide to Hazardous Materials, 13th ed., Nationial Fire Protection Association (NFPA)
-Registry of Toxic Effects of Chemical Substances (RTECS)
-Chemical Hazard Response Information System (CHRIS)
-Hazardous Substance Data Bank (HSDB)
-New Jersey Hazardous Substance Fact Sheet
-Ariel Global View
-Reprotext System

Other Special Considerations: Not available.

Created: 10/09/2005 05:28 PM

Last Updated: 11/06/2008 12:00 PM



Health	2
Fire	3
Reactivity	0
Personal Protection	J

Material Safety Data Sheet
m-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: m-Xylene

Catalog Codes: SLX1066

CAS#: 108-38-3

RTECS: ZE2275000

TSCA: TSCA 8(b) inventory: m-Xylene

CI#: Not applicable.

Synonym: m-Methyltoluene

Chemical Name: 1,3-Dimethylbenzene

Chemical Formula: $C_6H_4(CH_3)_2$

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{m-}Xylene	108-38-3	100

Toxicological Data on Ingredients: m-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit.].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.
CARCINOGENIC EFFECTS: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance is toxic to blood, kidneys, the nervous system, liver.
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

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

Large Spill:
Flammable liquid, insoluble in water.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

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

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)
TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 139.3°C (282.7°F)

Melting Point: -47.87°C (-54.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 6 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Easily soluble in methanol, diethyl ether.
Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 5000 mg/kg [Rat.].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant).
Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: m-Xylene
Massachusetts RTK: m-Xylene
TSCA 8(b) inventory: m-Xylene
SARA 313 toxic chemical notification and release reporting: m-Xylene
CERCLA: Hazardous substances.: m-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable.
R38- Irritating to skin.
R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
-Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec.
-SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
-Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

Other Special Considerations: Not available.

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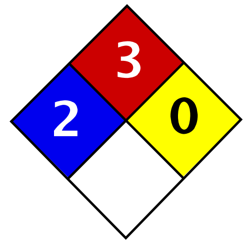

Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet
Toluene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Toluene

Catalog Codes: SLT2857, SLT3277

CAS#: 108-88-3

RTECS: XS5250000

TSCA: TSCA 8(b) inventory: Toluene

CI#: Not available.

Synonym: Toluol, Tolu-Sol; Methylbenzene; Methacide; Phenylmethane; Methylbenzol

Chemical Name: Toluene

Chemical Formula: C6-H5-CH3 or C7-H8

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

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

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

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Toluene	108-88-3	100

Toxicological Data on Ingredients: Toluene: ORAL (LD50): Acute: 636 mg/kg [Rat]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit]. VAPOR (LC50): Acute: 49000 mg/m 4 hours [Rat]. 440 ppm 24 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.
DEVELOPMENTAL TOXICITY: Not available.
The substance may be toxic to blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).
Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:
In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

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

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

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

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

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: CLOSED CUP: 4.4444°C (40°F). (Setaflash) OPEN CUP: 16°C (60.8°F).

Flammable Limits: LOWER: 1.1% UPPER: 7.1%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:
Flammable in presence of open flames and sparks, of heat.
Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available.
Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water.
SMALL FIRE: Use DRY chemical powder.
LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards:
Toluene forms explosive reaction with 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione; dinitrogen tetraoxide;

concentrated nitric acid, sulfuric acid + nitric acid; N2O4; AgClO4; BrF3; Uranium hexafluoride; sulfur dichloride. Also forms an explosive mixture with tetranitromethane.

Section 6: Accidental Release Measures

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

Large Spill:
Toxic flammable liquid, insoluble or very slightly soluble in water.
Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:
Store in a segregated and approved area. Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

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

Personal Protection:
Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

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

Exposure Limits:
TWA: 200 STEL: 500 CEIL: 300 (ppm) from OSHA (PEL) [United States]
TWA: 50 (ppm) from ACGIH (TLV) [United States] SKIN
TWA: 100 STEL: 150 from NIOSH [United States]
TWA: 375 STEL: 560 (mg/m3) from NIOSH [United States]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Sweet, pungent, Benzene-like.

Taste: Not available.

Molecular Weight: 92.14 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 110.6°C (231.1°F)

Melting Point: -95°C (-139°F)

Critical Temperature: 318.6°C (605.5°F)

Specific Gravity: 0.8636 (Water = 1)

Vapor Pressure: 3.8 kPa (@ 25°C)

Vapor Density: 3.1 (Air = 1)

Volatility: Not available.

Odor Threshold: 1.6 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2.7

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether, acetone.

Solubility:
Soluble in diethyl ether, acetone.
Practically insoluble in cold water.
Soluble in ethanol, benzene, chloroform, glacial acetic acid, carbon disulfide.
Solubility in water: 0.561 g/l @ 25 deg. C.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks, static), incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Incompatible with strong oxidizers, silver perchlorate, sodium difluoride, Tetranitromethane, Uranium Hexafluoride.
Frozen Bromine Trifluoride reacts violently with Toluene at -80 deg. C.
Reacts chemically with nitrogen oxides, or halogens to form nitrotoluene, nitrobenzene, and nitrophenol and halogenated products, respectively.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute oral toxicity (LD50): 636 mg/kg [Rat].
Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit].
Acute toxicity of the vapor (LC50): 440 24 hours [Mouse].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC.
May cause damage to the following organs: blood, kidneys, the nervous system, liver, brain, central nervous system (CNS).

Other Toxic Effects on Humans:
Hazardous in case of skin contact (irritant), of ingestion, of inhalation.
Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose:
LDL [Human] - Route: Oral; Dose: 50 mg/kg
LCL [Rabbit] - Route: Inhalation; Dose: 55000 ppm/40min

Special Remarks on Chronic Effects on Humans:
Detected in maternal milk in human. Passes through the placental barrier in human. Embryotoxic and/or foetotoxic in animal. May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic)

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects:
Skin: Causes mild to moderate skin irritation. It can be absorbed to some extent through the skin.
Eyes: Cauess mild to moderate eye irritation with a burning sensation. Splash contact with eyes also causes conjunctivitis, blepharospasm, corneal edema, corneal abraisons. This usually resolves in 2 days.
Inhalation: Inhalation of vapor may cause respiratory tract irritation causing coughing and wheezing, and nasal discharge. Inhalation of high concentrations may affect behavior and cause central nervous system effects characterized by nausea, headache, dizziness, tremors, restlessness, lightheadedness, exhilaration, memory loss, insomnia, impaired reaction time, drowsiness, ataxia, hallucinations, somnolence, muscle contraction or spasticity, unconsciousness and coma. Inhalation of high concentration of vapor may also affect the cardiovascular system (rapid heart beat, heart palpitations, increased or decreased blood pressure, dysrhythmia,), respiration (acute pulmonary edema, respiratory depression, apnea, asphyxia), cause vision disturbances and dilated pupils, and cause loss of appetite.
Ingestion: Aspiration hazard. Aspiration of Toluene into the lungs may cause chemical pneumonitis. May cause irritation of the digestive tract with nausea, vomiting, pain. May have effects similar to that of acute inhalation.
Chronic Potential Health Effects:
Inhalation and Ingestion: Prolonged or repeated exposure via inhalation may cause central nervous system and cardiovascular symptoms similar to that of acute inhalation and ingestion as well liver damage/failure, kidney damage/failure (with hematuria, proteinuria, oliguria, renal tubular acidosis), brain damage, weight loss, blood (pigmented or nucleated red blood cells, changes in white blood cell count), bone marrow changes, electrolyte imbalances (Hypokalemia, Hypophostatemia), severe, muscle weakness and Rhabdomyolysis.
Skin: Repeated or prolonged skin contact may cause defatting dermatitis.

Section 12: Ecological Information

Ecotoxicity:
Ecotoxicity in water (LC50): 313 mg/l 48 hours [Daphnia (daphnia)]. 17 mg/l 24 hours [Fish (Blue Gill)]. 13 mg/l 96 hours [Fish (Blue Gill)]. 56 mg/l 24 hours [Fish (Fathead minnow)]. 34 mg/l 96 hours [Fish (Fathead minnow)]. 56.8 ppm any hours [Fish (Goldfish)].

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may

arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Toluene UNNA: 1294 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Toluene
California prop. 65 (no significant risk level): Toluene: 7 mg/day (value)
California prop. 65 (acceptable daily intake level): Toluene: 7 mg/day (value)
California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Toluene
Connecticut hazardous material survey.: Toluene
Illinois toxic substances disclosure to employee act: Toluene
Illinois chemical safety act: Toluene
New York release reporting list: Toluene
Rhode Island RTK hazardous substances: Toluene
Pennsylvania RTK: Toluene
Florida: Toluene
Minnesota: Toluene
Michigan critical material: Toluene
Massachusetts RTK: Toluene
Massachusetts spill list: Toluene
New Jersey: Toluene
New Jersey spill list: Toluene
Louisiana spill reporting: Toluene
California Director's List of Hazardous Substances.: Toluene
TSCA 8(b) inventory: Toluene
TSCA 8(d) H and S data reporting: Toluene: Effective date: 10/04/82; Sunset Date: 10/0/92
SARA 313 toxic chemical notification and release reporting: Toluene
CERCLA: Hazardous substances.: Toluene: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).
CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):
R11- Highly flammable.
R20- Harmful by inhalation.
S16- Keep away from sources of ignition - No smoking.
S25- Avoid contact with eyes.
S29- Do not empty into drains.
S33- Take precautionary measures against static discharges.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves.
Lab coat.
Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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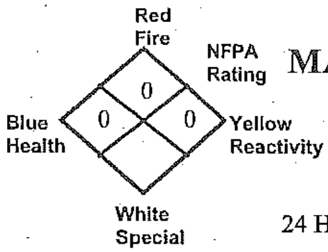
Alconox ®



MATERIAL SAFETY DATA SHEET

Alconox, Inc.
30 Glenn Street
White Plains, NY 10603

24 Hour Emergency Number – Chem-Tel (800) 255-3924

I. IDENTIFICATION

Product Name (as appears on label)	ALCONOX
CAS Registry Number:	Not Applicable
Effective Date:	January 1, 2001
Chemical Family:	Anionic Powdered Detergent
Manufacturer Catalog Numbers for sizes	1104, 1125, 1150, 1101, 1103 and 1112

II. HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

There are no hazardous ingredients in ALCONOX as defined by the OSHA Standard and Hazardous Substance List 29 CFR 1910 Subpart Z.

III. PHYSICAL/CHEMICAL CHARACTERISTICS

Boiling Point (F):	Not Applicable
Vapor Pressure (mm Hg):	Not Applicable
Vapor Density (AIR=1):	Not Applicable
Specific Gravity (Water=1):	Not Applicable
Melting Point:	Not Applicable
Evaporation Rate (Butyl Acetate=1):	Not Applicable
Solubility in Water:	Appreciable-Soluble to 10% at ambient conditions
Appearance:	White powder interspersed with cream colored flakes.
pH:	9.5 (1%)

IV. FIRE AND EXPLOSION DATA

Flash Point (Method Used):	None
Flammable Limits:	LEL: No Data UEL: No Data
Extinguishing Media:	Water, dry chemical, CO_2, foam
Special Fire fighting Procedures:	Self-contained positive pressure breathing apparatus and protective clothing should be worn when fighting fires involving chemicals.
Unusual Fire and Explosion Hazards:	None

V. REACTIVITY DATA

Stability:	Stable
Hazardous Polymerization:	Will not occur
Incompatibility (Materials to Avoid):	None
Hazardous Decomposition or Byproducts:	May release CO_2 on burning

VI. HEALTH HAZARD DATA

Route(s) of Entry:	Inhalation? Yes Skin? No Ingestion? Yes
Health Hazards (Acute and Chronic):	Inhalation of powder may prove locally irritating to mucous membranes. Ingestion may cause discomfort and/or diarrhea. Eye contact may prove irritating.
Carcinogenicity:	NTP? No IARC Monographs? No OSHA Regulated? No
Signs and Symptoms of Exposure:	Exposure may irritate mucous membranes. May cause sneezing.
Medical Conditions Generally Aggravated by Exposure:	Not established. Unnecessary exposure to this product or any industrial chemical should be avoided. Respiratory conditions may be aggravated by powder.
Emergency and First Aid Procedures:	Eyes: Immediately flush eyes with water for at least 15 minutes. Call a physician. Skin: Flush with plenty of water. Ingestion: Drink large quantities of water or milk. Do not induce vomiting. If vomiting occurs administer fluids. See a physician for discomfort.

VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken if Material is Released or Spilled:	Material foams profusely. Recover as much as possible and flush remainder to sewer. Material is biodegradable.
Waste Disposal Method:	Small quantities may be disposed of in sewer. Large quantities should be disposed of in accordance with local ordinances for detergent products.
Precautions to be Taken in Storing and Handling:	Material should be stored in a dry area to prevent caking.
Other Precautions:	No special requirements other than the good industrial hygiene and safety practices employed with any industrial chemical.

VIII. CONTROL MEASURES

Respiratory Protection (Specify Type):	Dust mask - Recommended
Ventilation:	Local Exhaust-Normal Special-Not Required Mechanical-Not Required Other-Not Required
Protective Gloves:	Impervious gloves are useful but not required.
Eye Protection:	Goggles are recommended when handling solutions.
Other Protective Clothing or Equipment:	None
Work/Hygienic Practices:	No special practices required

THE INFORMATION HEREIN IS GIVEN IN GOOD FAITH BUT NO WARRANTY IS EXPRESSED OR IMPLIED.

**** MATERIAL SAFETY DATA SHEET ****

Methanol
14280

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Methanol
Catalog Numbers:
, S75959, S75965, S75965A, S75965HPLC, S75965SPEC, A408-1, A408-4, A408SK-4 A411-20, A411-4, A412-1, A412-20, A412-200, A412-200LC, A412-4, A412-4LC, A412-500, A412-500LC, A412CU1300, A412FB115, A412FB19, A412FB200, A412FB50, A412J500, A412P-4, A412P-4LC, A412POP19, A412POP200, A412POP50, A412POPB19, A412POPB200, A412POPB50, A412RB115, A412RB19, A412RB200, A412RB50, A412RS115, A412RS200, A412RS28, A412RS50, A412SK-4, A412SS-115, A412SS-19, A412SS-200, A413-20, A413-200, A413-4, A413-500, A433F-1GAL, A433P-4, A433P1GAL, A433S-20, A433S-200, A433S-4, A434-20, A450-4, A452-1, A452-4, A452-4LC, A452J1, A452NB219, A452POP19, A452POP200, A452POP28, A452POP50, A452POPN19, A452RS-115, A452RS-19, A452RS-200, A452RS-28, A452RS-50, A452SK-1, A452SK-4, A452SS-115, A452SS-19, A452SS-200, A452SS-50, A453-1, A453-1LC, A453-500, A453J1, A454-1, A454-1LC, A454-4, A454-4LC, A454POP19, A454POP200, A454POP50, A454RS-115, A454RS-19, A454RS-200, A454RS-28, A454RS-50, A454SS-19, A454SS-28, A454SS-50, A455-1, A455POP19, A455POP200, A455POP50, A455SS19, A455SS200, A455SS50, A457-4, A935-4, A935FB200, A935POPB200, A935RB200, A936-1, A936-4, A947-4, A947-4LC, A947POP19, A947POP200, A947POP50, A947RS-115, A947RS-200, A947RS-28, A947SS-115, A947SS-19, A947SS-200, A947SS-28, A947SS-50, BP1105-1, BP1105-4, BP1105POP19, BP1105POP20, BP1105POP50, BP1105RS19, BP1105SS19, BP1105SS28, BP1105SS50, BP2618100, HC400 1GAL, NC9633361, NC9766429, NC9780216, NC9905242, NC9941388, NC9942270, NC9964975, NC9979250, SC95-1, SW2-1, TIA9474, TIA947P200L .

Synonyms:
Carbinol; Methyl alcohol; Methyl hydroxide; Monohydroxymethane; Wood alcohol; Wood naptha; Wood spirits; Columbian spirits; Methanol.

Company Identification: Fisher Scientific
1 Reagent Lane
Fairlawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
67-56-1	Methanol	>99.0	200-659-6

Hazard Symbols: T F
Risk Phrases: 11 23/24/25 39/23/24/25

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: clear, colorless liquid. Flash Point: 11 deg C. Danger! Flammable liquid and vapor. Causes respiratory tract irritation. May cause central nervous system depression. Poison! Cannot be made non-poisonous. Causes eye and skin irritation. May be fatal or cause blindness if swallowed. Harmful if swallowed, inhaled, or absorbed through the skin. Vapor harmful.
Target Organs: Eyes, nervous system, optic nerve.

Potential Health Effects

Eye:
Methanol is a mild to moderate eye irritant. Inhalation, ingestion or skin absorption of methanol can cause significant disturbances in vision, including blindness.

Skin:
Causes moderate skin irritation. Harmful if absorbed through the skin. Prolonged and/or repeated contact may cause defatting of the skin and dermatitis. Methanol can be absorbed through the skin, producing systemic effects that include visual disturbances.

Ingestion:
Harmful if swallowed. May be fatal or cause blindness if swallowed. Aspiration hazard. May cause systemic toxicity with acidosis. May cause central nervous system depression, characterized by excitement, followed by headache, dizziness, drowsiness, and nausea. Advanced stages may cause collapse, unconsciousness, coma and possible death due to respiratory failure.

Inhalation:
Methanol is toxic and can very readily form extremely high vapor concentrations at room temperature. Inhalation is the most common route of occupational exposure. At first, methanol causes CNS depression with nausea, headache, vomiting, dizziness and incoordination. A time period with no obvious symptoms follows (typically 8-24 hrs). This latent period is followed by metabolic acidosis and severe visual effects which may include reduced reactivity and/or increased sensitivity to light, blurred, double

and/or snowy vision, and blindness. Depending on the severity of exposure and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects.

Chronic:
Prolonged or repeated skin contact may cause dermatitis. Chronic exposure may cause effects similar to those of acute exposure. Methanol is only very slowly eliminated from the body. Because of this slow elimination, methanol should be regarded as a cumulative poison. Though a single exposure may cause no effect, daily exposures may result in the accumulation of a harmful amount. Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations that did not produce significant maternal toxicity.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical aid.

Skin:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.

Ingestion:
Potential for aspiration if swallowed. Get medical aid immediately. Do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:
Effects may be delayed.

Antidote:
Ethanol may inhibit methanol metabolism.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
Containers can build up pressure if exposed to heat and/or fire. As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Water may be ineffective. Material is lighter than water and a fire may be spread by the use of water. Flammable liquid and vapor. Vapors are heavier than air and may travel to a source of ignition and flash back. Vapors can spread along the ground and collect in low or confined areas.

Extinguishing Media:
For small fires, use dry chemical, carbon dioxide, water spray or alcohol-resistant foam. Water may be ineffective. For large fires, use water spray, fog or alcohol-resistant foam. Do NOT use straight streams of water.

Autoignition Temperature: 464 deg C (867.20 deg F)
Flash Point: 11 deg C (51.80 deg F)
Explosion Limits, lower: 6.0 vol %
Explosion Limits, upper: 36.00 vol %
NFPA Rating: (estimated) Health: 1; Flammability: 3; Instability: 0

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:
Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Use water spray to disperse the gas/vapor. Remove all sources of ignition. Provide ventilation. A vapor suppressing foam may be used to reduce vapors. Water spray may reduce vapor but may not prevent ignition in closed spaces.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Ground and bond containers when transferring material. Avoid contact with eyes, skin, and clothing. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep container tightly closed. Do not ingest or inhale. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose empty containers to heat, sparks or open flames. Use only with adequate ventilation. Keep away from heat, sparks and flame. Avoid use in confined spaces. Avoid breathing vapor or mist.

Storage:
Keep away from heat, sparks, and flame. Keep away from sources of ignition. Store in a cool, dry, well-ventilated area away from incompatible substances. Flammables-area. Keep containers tightly closed.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local exhaust ventilation to keep airborne concentrations below the permissible exposure limits.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Methanol	200 ppm; 250 ppm STEL; skin - potential for cutaneous absorption	200 ppm TWA; 260 mg/m3 TWA 6000 ppm IDLH	200 ppm TWA; 260 mg/m3 TWA

OSHA Vacated PELs:
Methanol:
200 ppm TWA; 260 mg/m3 TWA

Personal Protective Equipment

Eyes:
Wear chemical goggles.

Skin:
Wear appropriate protective gloves to prevent skin exposure.

Clothing:
Wear appropriate protective clothing to prevent skin exposure.

Respirators:
A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant a respirator's use.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Liquid
Color:	clear, colorless
Odor:	alcohol-like - weak odor
pH:	Not available.
Vapor Pressure:	127 mm Hg @ 25 deg C
Vapor Density:	1.11 (Air=1)
Evaporation Rate:	5.2 (Ether=1)
Viscosity:	0.55 cP 20 deg C
Boiling Point:	64.7 deg C @ 760 mm Hg
Freezing/Melting Point:	-98 deg C
Decomposition Temperature:	Not available.
Solubility in water:	miscible
Specific Gravity/Density:	.7910 g/cm3 @ 20&C
Molecular Formula:	CH4O
Molecular Weight:	32.04

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable under normal temperatures and pressures.
Conditions to Avoid:
High temperatures, ignition sources, confined spaces.
Incompatibilities with Other Materials:
Strong oxidizing agents, strong acids, powdered aluminum, powdered magnesium.
Hazardous Decomposition Products:
Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide, formaldehyde.
Hazardous Polymerization: Will not occur.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 67-56-1: PC1400000
LD50/LC50:
CAS# 67-56-1: Draize test, rabbit, eye: 40 mg Moderate; Draize test, rabbit, eye: 100 mg/24H Moderate; Draize test, rabbit, skin: 20 mg/24H Moderate; Inhalation, rabbit: LC50 = 81000 mg/m3/14H; Inhalation, rat: LC50 = 64000 ppm/4H; Oral, mouse: LD50 = 7300 mg/kg; Oral, rabbit: LD50 = 14200 mg/kg; Oral, rat: LD50 = 5600 mg/kg; Skin, rabbit: LD50 = 15800 mg/kg.
Human LDLo Oral: 143 mg/kg.
Inhalation: 300 ppm caused visual field changes & headache.
LDLo Skin: 393 mg/kg.
experimental animals than humans, because most animal species metabolize methanol differently. Non-primate species do not ordinarily show symptoms of metabolic acidosis or the visual effects

which have been observed in primates and humans.
Carcinogenicity:
Methanol -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology:
No data available.
Teratogenicity:
There is no human information available. Methanol is considered to be a potential developmental hazard based on animal data. In animal experiments, methanol has caused fetotoxic or teratogenic effects without maternal toxicity.
Reproductive Effects:
See actual entry in RTECS for complete information.
Neurotoxicity:
ACGIH cites neuropathy, vision and CNS under TLV basis.
Mutagenicity:
See actual entry in RTECS for complete information.
Other Studies:
No data available.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Ecotoxicity:
Fish: Fathead Minnow: 29.4 g/L; 96 Hr; LC50 (unspecified)Fish: Goldfish: 250 ppm; 11 Hr; resulted in deathFish: Rainbow trout: 8000 mg/L; 48 Hr; LC50 (unspecified)Fish: Rainbow trout: LC50 = 13-68 mg/L; 96 Hr.; 12 degrees CFish: Fathead Minnow: LC50 = 29400 mg/L; 96 Hr.; 25 degrees C, pH 7.63Fish: Rainbow trout: LC50 = 8000 mg/L; 48 Hr.; UnspecifiedBacteria: Phytobacterium phosphoreum: EC50 = 51,000-320,000 mg/L; 30 minutes; Microtox test

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: CAS# 67-56-1: waste number U154 (Ignitable waste).

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: METHANOL
Hazard Class: 3
UN Number: UN1230
Packing Group: II
Canadian TDG
Shipping Name: METHANOL
Hazard Class: 3.61
UN Number: UN1230
Other Information: FLASHPOINT 11 C

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 67-56-1 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
CERCLA Hazardous Substances and corresponding RQs
CAS# 67-56-1: 5000 lb final RQ; 2270 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 67-56-1: acute, flammable.
Section 313
This material contains Methanol (CAS# 67-56-1, 99 0%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.
Clean Air Act:
CAS# 67-56-1 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
None of the chemicals in this product are listed as Hazardous Substances under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.

STATE
Methanol can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
California No Significant Risk Level:
None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: T F
Risk Phrases:
R 11 Highly flammable.
R 23/24/25 Toxic by inhalation, in contact with skin and if swallowed.
R 39/23/24/25 Toxic : danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
Safety Phrases:
S 7 Keep container tightly closed.
S 16 Keep away from sources of ignition - No smoking.
S 36/37 Wear suitable protective clothing and gloves.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

WGK (Water Danger/Protection)
CAS# 67-56-1: 1

United Kingdom Occupational Exposure Limits
CAS# 67-56-1: OES-United Kingdom, TWA 200 ppm TWA; 266 mg/m3 TWA
CAS# 67-56-1: OES-United Kingdom, STEL 250 ppm STEL; 333 mg/m3 STEL

United Kingdom Maximum Exposure Limits

Canada
CAS# 67-56-1 is listed on Canada's DSL List.
This product has a WHMIS classification of B2, D1B, D2B.
CAS# 67-56-1 is listed on Canada's Ingredient Disclosure List.

Exposure Limits
CAS# 67-56-1: OEL-ARAB Republic of Egypt:TWA 200 ppm (260 mg/m3);Skin

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 7/21/1999 Revision #11 Date: 10/21/2002

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

**** MATERIAL SAFETY DATA SHEET ****

Nitric Acid
16550

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Nitric Acid
Catalog Numbers:
, S71972, S71972MF, S75623-2, S75623-3, S76523, A198C-212, A198C4X-212, A200-212, A200-500, A200-612GAL, A200C-212, A200C4X-212, A200C4X2001, A200C4X2122, A200C4X212L, A200J500, A200S-212, A200S-500, A200S4X-212, A200S4X212L, A200SI-212, A467-1, A467-2, A467-250, A467-500, A483-212, A509-212, A509-500, A509SK-212, S719721, S719721MF, S71972SC
Synonyms:
Azotic Acid; Engravers Nitrate; Hydrogen Nitrate.
Company Identification: Fisher Scientific
1 Reagent Lane
Fairlawn, NJ 07410
For information, call: 201-796-7100
Emergency Number: 201-796-7100
For CHEMTREC assistance, call: 800-424-9300
For International CHEMTREC assistance, call: 703-527-3887

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
7697-37-2	Nitric acid	69-71	231-714-2
7732-18-5	Water	29-31	231-791-2

Hazard Symbols: O C
Risk Phrases: 35 8

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: clear to yellow liquid.
Danger! Strong oxidizer. Contact with other material may cause a fire. Corrosive. Causes eye and skin burns. Causes digestive and respiratory tract burns. Check internal container upon receipt. Bottles should be vented periodically to relieve preasure.
Target Organs: Eyes, skin, mucous membranes.

Potential Health Effects
Eye:
Causes severe eye burns. May cause irreversible eye injury. May cause chemical conjunctivitis and corneal damage.
Skin:
Causes skin burns. May cause deep, penetrating ulcers of the skin. May cause skin rash (in milder cases), and cold and clammy skin with cyanosis or pale color.
Ingestion:
May cause severe and permanent damage to the digestive tract. Causes gastrointestinal tract burns. May cause perforation of the digestive tract. May cause systemic effects.
Inhalation:
Effects may be delayed. Causes chemical burns to the respiratory tract. Inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema. Aspiration may lead to pulmonary edema. May cause systemic effects. May cause acute pulmonary edema, asphyxia, chemical pneumonitis, and upper airway obstruction caused by edema.
Chronic:
Repeated inhalation may cause chronic bronchitis. Repeated exposure may cause erosion of teeth. Effects may be delayed.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:
Get medical aid immediately. Do NOT allow victim to rub or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).
Skin:
Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.
Ingestion:
Do NOT induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.
Inhalation:
Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration

using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Strong oxidizer. Contact with combustible materials may cause a fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Use water spray to keep fire-exposed containers cool. Substance is noncombustible. Use water with caution and in flooding amounts.
Extinguishing Media:
Substance is noncombustible; use agent most appropriate to extinguish surrounding fire. Contact professional fire-fighters immediately.
Autoignition Temperature: Not available.
Flash Point: Not available.
Explosion Limits, lower: Not available.
Explosion Limits, upper: Not available.
NFPA Rating: (estimated) Health: 4; Flammability: 0; Instability: 0; Specia

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks:
Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up spills immediately, observing precautions in the Protective Equipment section. Neutralize spill with sodium bicarbonate. Provide ventilation. A vapor suppressing foam may be used to reduce vapors.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:
Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not breathe dust, vapor, mist, or gas. Keep container tightly closed. Avoid contact with clothing and other combustible materials. Do not get on skin or in eyes. Avoid ingestion and inhalation. Discard contaminated shoes.
Storage:
Keep away from heat, sparks, and flame. Do not store near combustible materials. Keep container closed when not in use. Store in a cool, dry, well-ventilated area away from incompatible substances. Bottles should be vented periodically in order to overcome pressure buildup.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:
Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Nitric acid	2 ppm; 4 ppm STEL	2 ppm TWA; 5 mg/m3 TWA 25 ppm IDLH	2 ppm TWA; 5 mg/m3 TWA
Water	none listed	none listed	none listed

OSHA Vacated PELs:
Nitric acid:
2 ppm TWA; 5 mg/m3 TWA
Water:
No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:
Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin:
Wear appropriate gloves to prevent skin exposure.
Clothing:
Wear a chemical apron. Wear appropriate clothing to prevent skin exposure.

Respirators:
Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State:	Liquid
Color:	clear to yellow
Odor:	strong odor - acrid odor
pH:	1.0
Vapor Pressure:	6.8 mm Hg
Vapor Density:	Not available.
Evaporation Rate:	Not available.
Viscosity:	Not available.
Boiling Point:	186.8 deg F
Freezing/Melting Point:	-43.6 deg F
Decomposition Temperature:	Not available.
Solubility in water:	Soluble in water.
Specific Gravity/Density:	1.50
Molecular Formula:	HNO_3
Molecular Weight:	63.0119

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable. Decomposes when in contact with air, light, or organic matter.
Conditions to Avoid:
High temperatures, incompatible materials, ignition sources, moisture, combustible materials, reducing agents.
Incompatibilities with Other Materials:
Reducing agents, combustible materials, strong bases, alcohols, aldehydes, cyanides, metals, Incompatible with many substances..
Hazardous Decomposition Products:
Nitrogen oxides.
Hazardous Polymerization: Has not been reported.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 7697-37-2: QU5775000 QU5900000
CAS# 7732-18-5: ZC0110000
LD50/LC50:
CAS# 7697-37-2: Inhalation, rat: LC50 = 260 mg/m3/30M; Inhalation, rat: LC50 = 130 mg/m3/4H; Inhalation, rat: LC50 = 67 ppm(NO2)/4H.
CAS# 7732-18-5: Oral, rat: LD50 = >90 mL/kg.
Carcinogenicity:
Nitric acid -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Water -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology:
No information found.
Teratogenicity:
No information found.
Reproductive Effects:
No information found.
Neurotoxicity:
No information found.
Mutagenicity:
No information found.
Other Studies:
See actual entry in RTECS for complete information.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

Other
No information available.

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT
Shipping Name: NITRIC ACID
Hazard Class: 8
UN Number: UN2031
Packing Group: II

Canadian TDG
Shipping Name: NITRIC ACID
Hazard Class: 8(9.2)
UN Number: UN2031

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL
TSCA
CAS# 7697-37-2 is listed on the TSCA inventory.
CAS# 7732-18-5 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
CERCLA Hazardous Substances and corresponding RQs
CAS# 7697-37-2: 1000 lb final RQ; 454 kg final RQ
SARA Section 302 Extremely Hazardous Substances
CAS# 7697-37-2: 1,000 lb TPQ
SARA Codes
CAS # 7697-37-2: acute, chronic, flammable.
Section 313
This material contains Nitric acid (CAS# 7697-37-2, 69 71%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.
Clean Air Act:
This material does not contain any hazardous air pollutants.
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
CAS# 7697-37-2 is listed as a Hazardous Substance under the CWA.
None of the chemicals in this product are listed as Priority Pollutants under the CWA.
None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
Nitric acid can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.
Water is not present on state lists from CA, PA, MN, MA, FL, or NJ.
California No Significant Risk Level:
None of the chemicals in this product are listed.
European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols: O C
Risk Phrases:
R 35 Causes severe burns.
R 8 Contact with combustible material may cause fire.
Safety Phrases:
S23B Do not breathe fumes.
S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S 36 Wear suitable protective clothing.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
WGK (Water Danger/Protection)
CAS# 7697-37-2: 1
CAS# 7732-18-5: No information available.
United Kingdom Occupational Exposure Limits
CAS# 7697-37-2: OES-United Kingdom, TWA 2 ppm TWA; 5.2 mg/m3 TWA
CAS# 7697-37-2: OES-United Kingdom, STEL 4 ppm STEL; 10 mg/m3 STEL
CAS# 7697-37-2: OES-United Kingdom, STEL 4 ppm STEL; 10 mg/m3 STEL

United Kingdom Maximum Exposure Limits

Canada
CAS# 7697-37-2 is listed on Canada's DSL List.
CAS# 7732-18-5 is listed on Canada's DSL List.
This product has a WHMIS classification of C, D1A, E.
CAS# 7697-37-2 is listed on Canada's Ingredient Disclosure List.
CAS# 7732-18-5 is not listed on Canada's Ingredient Disclosure List.
Exposure Limits
CAS# 7697-37-2: OEL-ARAB Republic of Egypt:TWA 2 ppm (5 mg/m3)
OEL-AUSTRALIA:TWA 2 ppm (5 mg/m3);STEL 4 ppm (10 mg/m3)
OEL-BELGIUM:TWA 2 ppm (5.2 mg/m3);STEL 4 ppm (10 mg/m3)
OEL-CZECHOSLOVAKIA:TWA 2.5 mg/m3;STEL 5 mg/m3
OEL-DENMARK:TWA 2 ppm (5 mg/m3)
OEL-FINLAND:TWA 2 ppm (5 mg/m3);STEL 5 ppm (13 mg/m3);Skin
OEL-FRANCE:TWA 2 ppm (5 mg/m3);STEL 4 ppm (10 mg/m3)
OEL-GERMANY:TWA 10 ppm (25 mg/m3)

OEL-HUNGARY:STEL 5 mg/m3
OEL-JAPAN:TWA 2 ppm (5.2 mg/m3)
OEL-THE PHILIPPINES:TWA 2 ppm (5 mg/m3)
OEL-POLAND:TWA 10 mg/m3
OEL-RUSSIA:TWA 2 ppm;STEL 2 mg/m3;Skin
OEL-SWEDEN:TWA 2 ppm (5 mg/m3);STEL 5 ppm (13 mg/m3)
OEL-SWITZERLAND:TWA 2 ppm (5 mg/m3);STEL 4 ppm (1 mg/m3)
OEL-THAILAND:TWA 2 ppm (5 mg/m3)
OEL-TURKEY:TWA 2 ppm (5 mg/m3)
OEL-UNITED KINGDOM:TWA 2 ppm (5 mg/m3);STEL 4 ppm (10 mg/m3)
OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 9/30/1998 Revision #10 Date: 4/01/2003

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET: CRYSTAL SIMPLE GREEN®

I. PRODUCT & COMPANY INFORMATION

PRODUCT NAME: **CRYSTAL SIMPLE GREEN®**
OTHER NAMES: **CRYSTAL SIMPLE GREEN® - SPECIALIZED CLEANER / DEGREASER**
SIMPLE GREEN SAFETY TOWELS (fluid only)

COMPANY NAME: **SUNSHINE MAKERS, INC.**
15922 Pacific Coast Highway
Huntington Harbour, CA 92649 USA
Telephone: 800-228-0709 • 562-795-6000
Fax: 562-592-3034
Website: www.simplegreen.com

Version No. 4006
Issue Date: January 2002

For 24-hour emergency, call Chem-Tel, Inc.: 800-255-3924

USE OF PRODUCT: A specialized cleaner and degreaser for use in the industrial and institutional workplace..

II. INGREDIENT INFORMATION

The only ingredient of Crystal Simple Green® with established exposure limits is undiluted 2-butoxyethanol (<6%) (Butyl Cellosolve; CAS No. 111-76-2): the OSHA PEL and ACGIH TLV is 25 ppm (skin). Note, however, that Butyl Cellosolve is only one of the raw material ingredients that undergo processing and dilution during the manufacture of Crystal Simple Green®. Upon completion of the manufacturing process, Crystal Simple Green® does not possess the occupational health risks associated with exposure to undiluted Butyl Cellosolve. Verification of this is contained in the independent test results detailed under "Toxicological Information" on Page 3 of this MSDS.

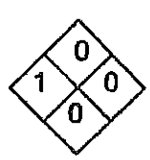
The Butyl Cellosolve in Crystal Simple Green® is part of a chemical category (glycol ethers) regulated by the Emergency Planning and Community Right-to-Know Act (SARA, Title III, section 313); therefore, a reporting requirement exists. Based upon chemical analysis, Crystal Simple Green® contains no known EPA priority pollutants, heavy metals, or chemicals listed under RCRA, CERCLA, or CWA. Analysis by TCLP (Toxicity Characteristic Leaching Procedure) according to RCRA revealed no toxic organic or inorganic constituents.

All components of Crystal Simple Green® are listed on the TSCA Chemical Substance Inventory.

III. HAZARDS IDENTIFICATION

UN Number: Not required
Dangerous Goods Class: Nonhazardous

Hazard Rating (NFPA/HMIS)
Health = 1* Reactivity = 0
Fire = 0 Special = 0



Rating Scale
0 = minimal 1 = slight
2 = moderate 3 = serious
4 = severe

*Mild eye irritant, non-mutagenic and non-carcinogenic. **None of the ingredients in Crystal Simple Green® are regulated or listed as potential cancer agents by Federal OSHA, NTP, or IARC.**

IV. FIRST AID MEASURES

SYMPTOMS OF OVEREXPOSURE AND FIRST AID TREATMENT

Eye contact: Reddening may develop. Immediately rinse the eye with large quantities of cool water; continue 10-15 minutes or until the material has been removed; be sure to remove contact lenses, if present, and to lift upper and lower lids during rinsing. Get medical attention if irritation persists.

Skin contact: Minimal effects, if any; rinse skin with water, rinse shoes and launder clothing before reuse. Reversible reddening may occur in some dermal-sensitive users; thoroughly rinse area and get medical attention if reaction persists.

Swallowing: Essentially non-toxic. Give several glasses of water to dilute; do not induce vomiting. If stomach upset occurs, consult physician.

Inhalation: Non-toxic. Exposures to concentrate-mist may cause mild irritation of nasal passages or throat; remove to fresh air. Get medical attention if irritation persists.

V. FIRE FIGHTING MEASURES

Crystal Simple Green® is stable, not flammable, and will not burn.

Flash Point/Auto-Ignition:	Not flammable.
Flammability Limits:	Not flammable.
Extinguishing Media:	Not flammable/nonexplosive. No special procedures required.
Special Fire Fighting Procedures:	None required.

VI. ACCIDENTAL RELEASE MEASURES

Recover usable material by convenient method; residual may be removed by wipe or wet mop. If necessary, unrecoverable material may be washed to drain with large quantities of water.

VII. HANDLING, STORAGE & TRANSPORT INFORMATION

No special precautions are required. **This product is non-hazardous for storage and transport according to the U.S. Department of Transportation Regulations.** Crystal Simple Green® requires no special labeling or placarding to meet U.S. Department of Transportation requirements.

UN Number:	Not required
Dangerous Goods Class:	Nonhazardous

VIII. EXPOSURE CONTROLS

Exposure Limits: The Crystal Simple Green® formulation presents no health hazards to the user when used according to label directions for its intended purposes. Mild skin and eye irritation is possible (please see Eye contact and Skin contact in Section IV.).

Ventilation: No special ventilation is required during use. Large-scale uses indoors should provide an increased rate of air exchange.

Human Health Effects or Risks from Exposure: Adverse effects on human health are not expected from Crystal Simple Green®, based upon twenty years of use of Simple Green without reported adverse health incidence in diverse population groups, including extensive use by inmates of U.S. Federal prisons in cleaning operations.

Crystal Simple Green® is a mild eye irritant; mucous membranes may become irritated by concentrate-mist.

Crystal Simple Green® is not likely to irritate the skin in the majority of users. Repeated daily application to the skin without rinsing, or continuous contact of Crystal Simple Green® on the skin may lead to temporary, but reversible, irritation.

Medical Conditions Aggravated by Exposure: No aggravation of existing medical conditions is expected; dermal-sensitive users may react to dermal contact by Crystal Simple Green®.

IX. PERSONAL PROTECTION

Precautionary Measures: No special requirements under normal use conditions.
Eye Protection: Caution, including reasonable eye protection, should always be used to avoid eye contact where splashing may occur.
Skin Protection: No special precautions required; rinse completely from skin after contact.
Respiratory Protection: No special precautions required except during large-scale spray applications where spray mist levels are high.
Work and Hygienic Practices: Wash or rinse hands before touching eyes or contact lenses. Follow standard hygienic practices for handling cleaning agents.

X. PHYSICAL AND CHEMICAL PROPERTIES

Appearance/odor::	Clear liquid	Vapor Pressure:	18 mm Hg @ 20 °C; 23.5 mm Hg @ 26 °C
Specific Gravity:	1.020	Vapor Density:	1.3 (air = 1)
pH of concentrate:	9.35	Density:	8.5 lbs./gallon
Evaporation:	>1 (butyl acetate = 1)		
Boiling Point:	100.6 °C (212 °F)		
Freezing Point:	-9 °C (16 °F) If product freezes, it will reconstitute without loss of efficacy when brought back to room temperature and agitated.		

VOC Composite Partial Pressure: 0 mm Hg @ 20 °C
Volatile Organic Compounds (VOCs): 0 g/L per ASTM Method D-2369. Per California AQMD's VOC test method, product must be diluted at least 2 parts of water to 1 part Crystal Simple Green® in order to meet SCAQMD Rule 1171 & Rule 1122 and BAAQMD Regulation 8-16 VOC requirements for solvent cleaning operations.
Water Solubility: Completely soluble in water.
Detection: Crystal Simple Green® has a characteristic odor that is not indicative of any hazardous situation.

XI. STABILITY AND REACTIVITY INFORMATION

Nonreactive. Crystal Simple Green® is stable, even under fire conditions, and will not react with water or oxidizers. Hazardous polymerization will not occur.

XII. TOXICOLOGICAL INFORMATION

The information and conclusions cited in this section are based on data and testing of Simple Green®. The data are directly applicable to Crystal Simple Green® because, except for the fragrance and dyes which have been removed, it contains the same ingredients as Simple Green®.

Nonhuman Toxicity
Acute Mortality Studies:
Oral LD_{50} (rat): >5.0 g/kg body weight // Dermal LD_{50} (rabbit): >2.0 g/kg body weight
Dermal Irritation: Only mild, but reversible, irritation was found in a standard 72-hr test on rabbits. A value of 0.2 (non-irritating) was found on a scale of 8.

Eye Irritation: With or without rinsing with water, the irritation scores in rabbits at 24 hours did not exceed 15 (mild irritant)
on a scale of 110.

Subchronic dermal effects: No adverse effects, except reversible dermal irritation, were found in rabbits exposed to Simple Green® (up to 2.0 g/kg/day for 13 weeks) applied to the skin of 25 males and 25 females. Only female body weight gain was affected. Detailed microscopic examination of all major tissues showed no adverse changes.

Fertility Assessment by Continuous Breeding: The Simple Green® formulation had no adverse effect on fertility and reproduction in CD-1 mice with continuous administration for 18 weeks, and had no adverse effect on the reproductive performance of their offspring.

XIII. BIODEGRADABILITY AND ENVIRONMENTAL TOXICITY INFORMATION

Biodegradability:
Like Simple Green®, Crystal Simple Green® is readily decomposed by naturally occurring microorganisms. The biological oxygen demand (BOD), as a percentage of the chemical oxygen demand (COD), after 4, 7, and 11 days was 56%, 60%, and 70%, respectively. Per OECD Closed Bottle Test, Crystal Simple Green® meets OECD and EPA recommendations for ready biodegradability.

In a standard biodegradation test with soils from three different countries, Butyl Cellosolve reached 50% degradation in 6 to 23 days, depending upon soil type, and exceeded the rate of degradation for glucose, which was used as a control for comparison.

Environmental Toxicity Information:
Crystal Simple Green® is considered practically non-toxic per EPA's aquatic toxicity scale.

XIV. DISPOSAL CONSIDERATIONS

Crystal Simple Green® is fully water soluble and biodegradable and will not harm sewage-treatment microorganisms if disposal by sewer or drain is necessary. Dispose of in accordance with all applicable local, state, and federal laws.

XV. OTHER INFORMATION

Containers:	Crystal Simple Green® residues can be completely removed by rinsing with water; the container may be recycled or applied to other uses.
Contact Point:	Sunshine Makers, Inc., Research and Development Division: 562-795-6000.

***** NOTICE *****

All information appearing herein is based upon data obtained by the manufacturer and recognized technical sources. Judgments as to the suitability of information herein for purchaser's purposes are necessarily purchaser's responsibility. Therefore, although reasonable care has been taken in the preparation of this information, Sunshine Makers, Inc. or its distributors extends no warranties, makes no representations and assumes no responsibility as to the suitability of such information for application to purchaser's intended purposes or for consequences of its use.

Appendix C

Heat Stress and Cold Stress Guidelines

Heat Stress Guidelines

Form	Signs & Symptoms	Care	Prevention[3]
Heat Rash	Tiny red vesicles in affected skin area. If the area is extensive, sweating can be impaired.	Apply mild lotions and cleanse the affected area.	Cool resting and sleeping areas to permit skin to dry between heat exposures.
Heat Cramps	Spasm, muscular pain (cramps) in stomach area and extremities (arms and legs).	Provide replacement fluids with minerals (salt) such as Gatorade.	Adequate salt intake with meals[1]. ACCLIMATIZATION[2]
Heat Exhaustion	Profuse sweating, cool (clammy) moist skin, dizziness, confusion, pale skin color, faint, rapid shallow breathing, headache, weakness, and/or muscle cramps.	Remove from heat, sit or lie down, rest, replace lost water with electrolyte replacement fluids (water, Gatorade) take frequent sips of liquids in amounts greater than required to satisfy thirst.	ACCLIMATIZATION[2] Adequate salt intake with meals[1], only during early part of heat season. Ample water intake, frequently during the day.
Heat Stroke	HOT Dry Skin. Sweating has stopped. Mental confusion, dizziness, nausea, chills, severe headache, collapse, delirium, and/or coma.	HEAT STROKE IS A MEDICAL EMERGENCY • Remove from heat. • COOL THE BODY AS RAPIDLY AS POSSIBLE by immersing in cold (or cool) water, or splash with water and fan. • Call for Emergency Assistance. • Observe for signs of shock.	ACCLIMATIZATION[2] Initially moderate workload in heat (8 to 14 days). Monitor worker's activities.

Footnotes:

1.) American diets are normally high in salt, sufficient to aid acclimatization. However, during the early part of the heat season, (May, June), one extra shake of salt during one to two meals per day may help, so long as this is permitted by your physician. Check with your personal physician.

2.) ACCLIMATIZATION - The process of adapting to heat is indicated by worker's ability to perform hot jobs less fluid loss, lower concentrations of salt loss in sweat, and a reduced core (body) temperature and heart rate.

3.) Method to Achieve Acclimatization - Moderate work or exercise in hot temperatures during early part of heat season. Adequate salt (mineral) and water intake. Gradually increasing work time in hot temperatures. Avoid alcohol. Normally takes 8 to 14 days to achieve acclimatization. Lost rapidly, if removed from strenuous work (or exercise) in hot temperature for more than approximately 5 days.

Cold Stress Guidelines

Stress	Symptoms	What to do
Mild Hypothermia	• Body Temp 98 to 90°F • Shivering • Lack of coordination, stumbling, fumbling hands • Slurred speech • Memory loss • Pale, cold skin	• Move to warm area • Stay active • Remove wet clothes and replace with dry clothes or blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90 to 86°F • Shivering stops • Unable to walk or stand • Confused and/or irrational	• All of the above, plus: o Call 911 o Cover all extremities completely o Place very warm objects, such as hot packs on the victim's head, neck, chest, and groin
Severe Hypothermia	• Body temp 86 to 78°F • Severe muscle stiffness • Very sleepy or unconscious • Ice cold skin • Death	• Call 911 • Treat victim very gently • Do not attempt to re-warm
Frostbite	• Cold, tingling, stinging, or aching feeling in the frostbitten area, followed by numbness • Skin color turns red, then purple, then white or very pale skin • Cold to the touch • Blisters in severe cases	• Call 911 • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm (not hot) water
Trench Foot	• Tingling, itching, or burning sensation • Blisters	• Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm (not hot) sugary drink

Appendix D

Forms

Please complete this form and send it to your Branch Manager, HR and CHSO ***within 24 hours*** of the incident.

GEI Consultants

Accident/Incident Report Form

SECTION A — ACCIDENT/INCIDENT DETAILS

EMPLOYEE INFORMATION:	OTHER INJURED (IF APPLICABLE):
Name: ____________	Name: ____________
Home Address: ____________ Street Address · City · State · Zip Code	Home Address: ____________ Street Address · City · State · Zip Code
Contact Information: ( ) ______ ( ) ______ Primary · Secondary	Contact Information: ( ) ______ ( ) ______ Primary · Secondary
Date of Birth: ____________	Date of Birth: ____________
Date of Hire: ____________	Date of Hire: ____________
Branch: ____________	Branch: ____________
Supervisor: ____________	Supervisor: ____________

Date and Time Accident/Incident	Date and Time Reported	LOCATION OF INCIDENT/ACCIDENT
______ /_____ /_____ Month Day Year	______ /_____ /_____ Month Day Year	Project Name: ____________ Client and Location: ____________ or ____________
_____ A.M. _____ P.M.	_____ A.M. _____ P.M.	Office Location: ____________

INCIDENT TYPE: (Check All That Applies)	WITNESS INFORMATION
☐ Personal Injury/Illness ☐ Vehicle Accident ☐ Property Damage ☐ Environmental Spill ☐ Other	Name: ____________ Contact Number: ____________ Company: ____________

WHAT HAPPENED TO THE INJURED PARTY: ☐ First Aid Administered ☐ Refused Treatment/Transport ☐ Transported to Hospital ☐ Returned to Work ☐ Went Home ☐ Went to Physician ☐ Unknown

Clinic/Hospital or Treating Physician: ____________ Phone: ____________

Name · Street Address · City · State · Zip Code

SECTION B — PERSONAL INJURY

Cause of Injury: ____________

Part of Body Injured: ____________ Multiple Injuries: ☐Y ☐N

Was PPE worn when injured? : ☐Y ☐N What PPE was worn? ____________

WAS INJURY A RESULT OF THE USE A MOTOR VEHICLE: ☐ YES ☐ NO **(If yes, complete Section C)**

Please complete this form and send it to your Branch Manager, HR and CHSO ***within 24 hours*** of the incident.

GEI Consultants

Accident/Incident Report Form

SECTION C AUTO ACCIDENT ONLY

DRIVER/VEHICLE INFORMATION

Name of Insured: ______________________

Department: ______________________

Driver's License Number: ______________________

DOB: ____/____/____ State: ______________________

Description of Vehicle: License Plate Number: __________

Make: ________ Model: ________ Year:_____ Color:________

Owner: ______________________

Name of Other Driver: ______________________

Driver's License Number: ______________________

State: ______________________

Description of Vehicle: License Plate Number: __________

Make: ________ Model:______ Year:_____ Color:________

Insurance Carrier: ______________________

Policy Number: ______________Ph. Number:______________

SECTION D PROPERTY DAMAGE OR CHEMICAL RELEASE ONLY

Type of Damage(s): ______________________

Cause of Damage(s): ______________________

Type of Chemical Released (if known): ______________________

Quantity of Chemical Released: ______________________

Spill Measures Employed: ______________________

SECTION E NATURE OF ACCIDENT/INCIDENT AND EXTENT OF INJURIES/DAMAGES

(Please give a detailed description of what happened. Attach a sketch or picture if applicable)

____

____

____

____

____

____

____

____

____

I hereby certify that the above information is true and correct to my understanding of this accident/incident.

______________________ ______________________

Employee/Preparer's Name **Date and Time**

Daily Safety Briefing Log and Site Visitor Sign-In

GEI Consultants

Project Number:	**Project Name:**
[1]**Date:**	**Time:**
Briefing Conducted by:	**Signature:**

This sign-in log documents the tailgate briefing conducted in accordance with the site specific HASP. Personnel who perform work operations on site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

TOPICS COVERED (check all those covered):

☐ General PPE Usage	☐ Confined Space	☐ Excavation Safety	☐ Other (Specify):
☐ Hearing Conservation	☐ Slips, Trips, Falls	☐ Confined Space	
☐ Respiratory Protection	☐ Heat Stress	☐ Traffic Safety	
☐ Personal Hygiene	☐ Cold Stresses	☐ Changes to the HASP	☐ Other (Specify):
☐ Exposure Guidelines	☐ Site Control	☐ Initial Review of Hazard Evaluation	
☐ Decon Procedures	☐ Work Zones	☐ Emergency Procedures (include route to hospital)	
	☐ Lockout/Tagout		

Daily Safety Topic Description:

Personnel Sign-in List

Printed Name	Signature	Company Name	Time-In	Time-Out

[1] This form is applicable for *only* 1 day of site activity.

NEAR MISS REPORT

A near miss is a potential hazard or incident that has not resulted in any personal injury. Unsafe working conditions, unsafe employee work habits, improper use of equipment, or use of malfunctioning equipment have the potential to cause work related injuries. It is everyone's responsibility to report and/or correct these potential accidents/incidents immediately. Please complete this form as a means to report these near-miss situations. <u>Send a copy of the completed form to the Project Manager, Regional Health and Safety Officer and the Corporate Health and Safety Officer.</u>

Location: _____ Site Name: _____

Date: _____ Time: _____ ☐ a.m. ☐ p.m.

Weather conditions, site operations taking place during near miss. _____

Please check all appropriate conditions:

☐ Unsafe Act ☐ Unsafe equipment

☐ Unsafe Condition ☐ Unsafe use of equipment

Description of incident or potential hazard: _____

Employees or sub-contractors involved if applicable._____

Employee Signature ______________________________ Date _____

Print Name _____

NEAR MISS INVESTIGATION

Description of the near-miss condition: _____
Causes (primary & contributing) _____
Corrective action taken (Remove the hazard, replace, repair, or retrain in the proper procedures for the task) _____
Actions not yet taken_____

Signed: ________________________________ Date Completed: _____

Print Name
Not completed for the following reason: ______Date:______

GEI Consultants

Project Safety Briefing Form

GEI Consultants

Project Number:	**Project Name:**	
Date:	**Time:**	**Project Manager:**
Briefing Conducted by:		**Signature:**

This sign-in log documents the project specific-briefing conducted in accordance with the HASP and GEI H&S policy. GEI personnel who perform work on site are required to attend the Project briefing and to acknowledge it's receipt. Applicable health and safety SOPs are also required to be reviewed in this briefing and attached as an appendix to the HASP. Prior to the start of the project **or upon the start of a new on-site project team member**, this form must be completed. Please email this completed form to Health&SafetyCommittee@geiconsultants.com.

TOPICS COVERED (check all those covered):

☐	General PPE Usage	☐	Excavation Safety	☐	SOP:
☐	Hearing Conservation	☐	Confined Space	☐	SOP:
☐	Respiratory Protection	☐	Traffic Safety	☐	SOP:
☐	Personal Hygiene	☐	Changes to the HASP	☐	SOP:
☐	Exposure Guidelines	☐	Site Control	☐	SOP:
☐	Decon Procedures	☐	Work Zones	☐	SOP:
☐	Emergency Procedures (include route to hospital)	☐	Lockout/Tagout	☐	SOP:
		☐	Review of Hazard Evaluation	☐	SOP:
☐	Confined Space			☐	SOP:
☐	Slips, Trips, Falls	☐	Other (Specify):	☐	SOP:
☐	Heat Stress	☐	Other (Specify):	☐	SOP:
☐	Cold Stress	☐	Other (Specify):	☐	SOP:

Personnel Sign-in List

Printed Name	Signature

Flow Chart for Accident Reporting on National Grid Sites

Employee	GEI reports incidents involving GEI personnel or subcontractor personnel including lost time injuries, injuries requiring medical attention, near miss incidents, fires, fatalities, accidents involving the public, and property damage.
Employee	The report is made to the GEI PM verbally within 2 hours of the incident.
PM	The PM **immediately** notifies the CHSO, Human Resources and the Project-Specific National Grid Representative for the incident. In addition the PM will notify the GEI National Grid Client Manager.
CHSO	The CHSO informs the President, COO and Regional Manager of the incident.
Employee	The GEI Accident/Incident Report form is completed by the injured employee and submitted to the CHSO and HR within ***12 hours*** of the incident.
PM with assist from CHSO or RHSO	A ***DRAFT*** Incident Report Form found in the appendix of the HASP is completed and submitted to the Project-Specific National Grid Representative **within 24 hours** of the incident.
RHSO	The GEI Regional Health and Safety Officer initiates an accident investigation within 24 hours of the receipt of the accident report.
RHSO	The accident investigation report is submitted to the CHSO for approval.
CHSO	Incidents are reported to the Operations Committee each month in the H&S

Appendix E

GEI's Health and Safety SOPs

STANDARD OPERATING PROCEDURES

SOP No. HS-001 Biological Hazards

1.1 Objective

The objective of this standard operating procedure (SOP) is to prevent or limit the potential for GEI personnel to encounter biological hazards during field activities.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for contact with biological hazards such as animals, insects, plants, and sewage. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with biological hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

1.2.1 Animals

During some site operations, animals such as stray or domesticated dogs or cats, raccoons, snakes, bears, rats, bats, etc. may be encountered. Employees should use discretion and attempt to avoid contact with animals. If these animals present a problem, efforts will be made to remove these animals from the site by contacting a licensed animal control technician.

1.2.1.1 Rabies

The rabies virus is transmitted through the bite of an infected animal or contact with saliva or brain/nervous system tissue of an infected animal. The rabies virus infects the central nervous system causing disease in the brain. The early symptoms of rabies in people are fever, headache, and general weakness or discomfort. As the disease progresses, more specific symptoms appear and may include insomnia, anxiety, confusion, slight or partial paralysis, excitation, hallucinations, agitation, hypersalivation (increase in saliva), difficulty swallowing, and hydrophobia (fear of water). Death usually occurs within days of the onset of these symptoms.

If you are bitten or think you may be exposed, wash any wounds immediately and thoroughly with soap and water. Then notify the Project Manager and Corporate Health and Safety Officer (CHSO) and go to the hospital emergency room. The doctor, possibly in consultation with the state or local health department, will decide if you need a rabies vaccination. Decisions to start vaccination will be based on your type of exposure and the animal you were exposed to, as well as laboratory and surveillance information for the geographic area where the exposure occurred. An Accident Report Form should be completed and submitted per GEI's accident reporting procedures.

1.2.2 Insects

Insects, including bees, wasps, hornets, mosquitoes, ticks, spiders, etc may be present at a job site making the chance of a bite/sting possible. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life threatening condition. Some insect bites can transmit diseases such as Lyme disease or a virus such as West Nile. The following is a list of preventive measures:

- Apply insect repellent prior to performing field work and as often as needed throughout the work shift
- Wear proper protective clothing (work boots, socks and light colored clothing)
- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many insects are most active (between dawn and dusk).
- When walking in wooded areas, avoid contact with bushes, tall grass, or brush as much as possible
- Field personnel who may have insect allergies should have bee sting allergy medication on site and should provide this information to the Site Safety Officer (SSO) and the CHSO prior to commencing work.
- Field personnel should perform a self-check at the end of the day for ticks.

1.2.3 Tick-borne Diseases

Lyme disease is caused by infection from a deer tick that carries a spirochete. During the painless tick bite, the spirochete may be transmitted into the bloodstream often after feeding on the host for 12 to 24 hours. The ticks that cause the disease are often no bigger than a poppy seed or a comma in newsprint. The peak months for human infection are from May to September.

Symptoms appear in three stages. First symptoms usually appear from 2 days to a few weeks after a person is bitten by an infected tick. Symptoms usually consist of a ring-like red rash on the skin where the tick was attached. The rash is often bulls-eye like with red around the edges and clear in the center. The rash may be warm, itchy, tender, and/or "doughy." Unfortunately, this rash appears in only 60 to 80 percent of infected persons. An infected person also has flu-like symptoms of a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. These symptoms often disappear after a few weeks.

The second stage symptoms, which occur weeks to months later include meningitis, severe headache, drooping of the muscles on the face, called Bell's Palsy, encephalitis, numbness, withdrawal and lethargy. These symptoms may last for several weeks to several months. Third stage symptoms, which occur months or years later include arthritis, heart problems, and loss of memory. The third stage symptoms may mimic multiple sclerosis and Alzheimer's disease.

Personnel should check themselves when in areas that could harbor deer ticks, wear light color clothing and visually check themselves and their buddy when coming from wooded or vegetated areas. If a GEI employee has been bitten by a tick, the CHSO should be contacted immediately. An Accident Report form must be completed by the individual in compliance with the Accident Reporting procedure outlined in the Corporate Health and Safety Manual.

From left to right: The deer tick adult female, adult male, nymph, and larva on a centimeter scale.

The tick can be removed by pulling gently at the head with tweezers. If tweezers are not available, cover your fingers with tissue paper and use them to grasp the tick. It is important to grasp the tick as close to the site of attachment and use a firm steady pull to remove it. Wash hands immediately after with soap and water. The affected area should then be disinfected with an antiseptic wipe. All mouth parts must be removed from the skin. If the tick is removed by breaking off the mouth parts, an irritation or infection may occur. Also, the organism that is causing the disease can still enter the body through the skin. The employee will be offered the option for medical treatment by a physician, which typically involves antibiotics. If personnel feel sick or have signs similar to those above, they should notify the SSO and the CHSO immediately.

Treatment with antibiotics is effective and recovery is usually complete. In the first stage antibiotics are usually given orally. Second and third stage treatment, however is prolonged and recovery may take longer. Antibiotic treatment is usually provided intravenously for second and third stage Lyme disease.

The deer tick can also cause **Babesiosis**, an infection of the parasite Babesia Microti. Symptoms of Baesiosis may not be evident, but may also include fever, fatigue and hemolytic anemia lasting from several days to several months. Babesiosis is most commonly diagnosed in the elderly or in individuals whose immune systems are compromised.

Ehrlichiosis is a tick-borne disease which can be caused by either of two different organisms. Human monocytic ehrlichiosis (HME) is caused by *Ehrlichia chaffeensis*, which is transmitted by the lone star tick (*Amblyomma americanum*). Human granulocytic anaplasmosis (HGA), previously known as human granulocytic ehrlichiosis (HGE), is caused by *Anaplasma phagocytophilia*, which is transmitted by the deer tick (*Ixodes scapularis*).

In New York State, most cases of ehrlichiosis have been reported on Long Island and in the Hudson Valley. Ehrlichiosis is transmitted by the bite of infected ticks, including the deer tick and the lone star tick. The symptoms of HME and HGE are the same and usually include fever, muscle aches, weakness and headache. Patients may also experience confusion, nausea, vomiting and joint pain. Unlike Lyme disease or Rocky Mountain spotted fever, a rash is not common. Infection usually produces mild to moderately severe illness, with high fever and headache, but may occasionally be life-threatening or even fatal. Symptoms appear one to three weeks after the bite of an infected tick. However, not every exposure results in infection.

Rocky Mountain spotted fever (RMSF) is a tick-borne disease caused by a rickettsia (a microbe that differs somewhat from bacteria and virus). Fewer than 50 cases are reported annually in New York State. In the eastern United States, children are infected most frequently, while in the western United States, disease incidence is highest among adult males. Disease incidence is directly related to exposure to tick-infested habitats or to infested pets. Most of the cases in New York State have occurred on Long Island. RMSF is characterized by a sudden onset of moderate to high fever (which can last for two or three weeks), severe headache, fatigue, deep muscle pain, chills and rash. The rash begins on the legs or arms, may include the soles of the feet or palms of the hands and may spread rapidly to the trunk or rest of the body. Symptoms usually appear within two weeks of the bite of an infected tick.

*(Information on Ehrlichiosis, Babesiosis, and Rocky Mountain Spotted Fever was derived from the New York State Department of Health).

1.2.4 West Nile Virus

West Nile Virus (WNV) is a mosquito-borne infection transmitted through the bite of an infected mosquito. The symptoms of WNV can be asymptomatic (no symptoms) or in more serious cases can lead to West Nile Fever. West Nile Fever can include fever, headache, tiredness, body ache, an occasional rash on the trunk of the body, and swollen lymph glands, In severe cases, people have developed West Nile Encephalitis or

Meningitis which symptoms include fever, headache, neck stiffness, tremors, coma and in some cases death. The incubation period for the disease is usually 2 to 15 days. The symptoms can range from a few days to several weeks. Most mosquitoes are not infected and the chance of infection from a mosquito bite of an on-site employee is very small.

The following precautions will be used to help reduce the risk of mosquito bites:

- Reduce mosquito-breeding areas by making sure wheelbarrows, buckets, and other containers are turned upside down when not used so that they do not collect standing water.
- Wear shoes, long pants with bottoms tucked into boots or socks, and a long-sleeved shirt when outdoors for long periods of time, or when many mosquitoes are most active (between dawn and dusk).
- Use mosquito repellant according to the manufacturer's directions when outdoors for long periods of time and when mosquitoes are most active.

Centers for Disease Control and Prevention (CDC) evaluation of information contained in peer-reviewed scientific literature and data available from the Environmental Protection Agency (EPA) has identified several EPA registered products that provide repellent activity sufficient to help people avoid the bites of disease carrying mosquitoes. Products containing these active ingredients typically provide reasonably long-lasting protection:

- **DEET** (Chemical Name: N,N-diethyl-m-toluamide or N,N-diethly-3-methyl-benzamide) 20 to 30 percent DEET
- **Picaridin** (KBR 3023, Chemical Name: 2-(2-hydroxyethyl)-1-piperidinecarboxylic acid 1-methylpropyl ester)
- **Oil of Lemon Eucalyptus** or **PMD** (Chemical Name: para-Menthane-3,8-diol) the synthesized version of oil of lemon eucalyptus
- **IR3535** (Chemical Name: 3-[N-Butyl-N-acetyl]-aminopropionic acid, ethyl ester)
- **Permethrin** (3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate) **-** Permethrin kills ticks and can be used on clothing (but not skin)

EPA characterizes the active ingredients DEET and Picaridin as "conventional repellents" and Oil of Lemon Eucalyptus, PMD, and IR3535 as "biopesticide repellents", which are derived from natural materials.

In general, higher concentrations of active ingredient provide longer duration of protection, regardless of the active ingredient, although concentrations above approximately 50 percent do not offer a marked increase in protection time. Products with less than 10 percent active ingredient may offer only limited protection, often from 1 to 2 hours. Products that offer sustained release or controlled release (micro-encapsulated) formulations, even with lower active ingredient concentrations, may provide longer protection times. Regardless of what product you use, if you start to get mosquito bites reapply the repellent according to the label instructions or remove yourself from the area with biting insects if possible.

Clothing and other products can be purchased pre-treated, or products can be treated using EPA-registered products. Permethrin is the only pesticide approved by the EPA for these uses. Permethrin binds tightly to the fabrics, resulting in little loss during washing and minimal transfer to the skin. Permethrin is poorly absorbed through the skin, although sunscreens and other products may increase the rate of skin absorption.

If you decide to use permethrin-treated clothing, consider these tips:

- Read the application instructions carefully and apply the product according to the label directions. Do not over-treat products.
- Permethrin treatments are only intended for use on fabrics; do not apply them directly to the skin or other items.
- Do not apply permethrin to clothing while it is being worn.
- Apply the products outdoors in well ventilated areas that are protected from wind.
- Hang treated fabrics outdoors and allow them to dry completely before wearing them.
- Wash permethrin treated clothing separately from other clothing items.

1.2.5 Plants

The potential for contact with poisonous plants, such as poison ivy, sumac, and oak, exists when performing fieldwork in wooded or boggy areas. These plants can cause allergic reaction when in contact with the leaves or vines.

Poison ivy can be found as vines on tree trunks or as upright bushes. Poison ivy consists of three leaflets with notched edges. Two leaflets form a pair on opposite sides of the stalk, and the third leaflet stands by itself at the tip. Poison ivy is red in the early spring and turns shiny green later in the spring. Poison ivy grows throughout much of North America, including all states east of the Rocky Mountains. It is normally found in wooded areas, especially along edge areas where the tree line breaks and allows sunshine to filter through. It also grows in exposed rocky areas, open fields and disturbed areas.

Poison sumac can be present in the form of a flat-topped shrub or tree. It has fern-like leaves, which are velvety dark green on top and pale underneath. The branches of immature trees have a velvety "down." Poison sumac has white, "hairy" berry clusters. Poison sumac grows exclusively in very wet or flooded soils, usually in swamps and peat bogs, in the eastern United States.

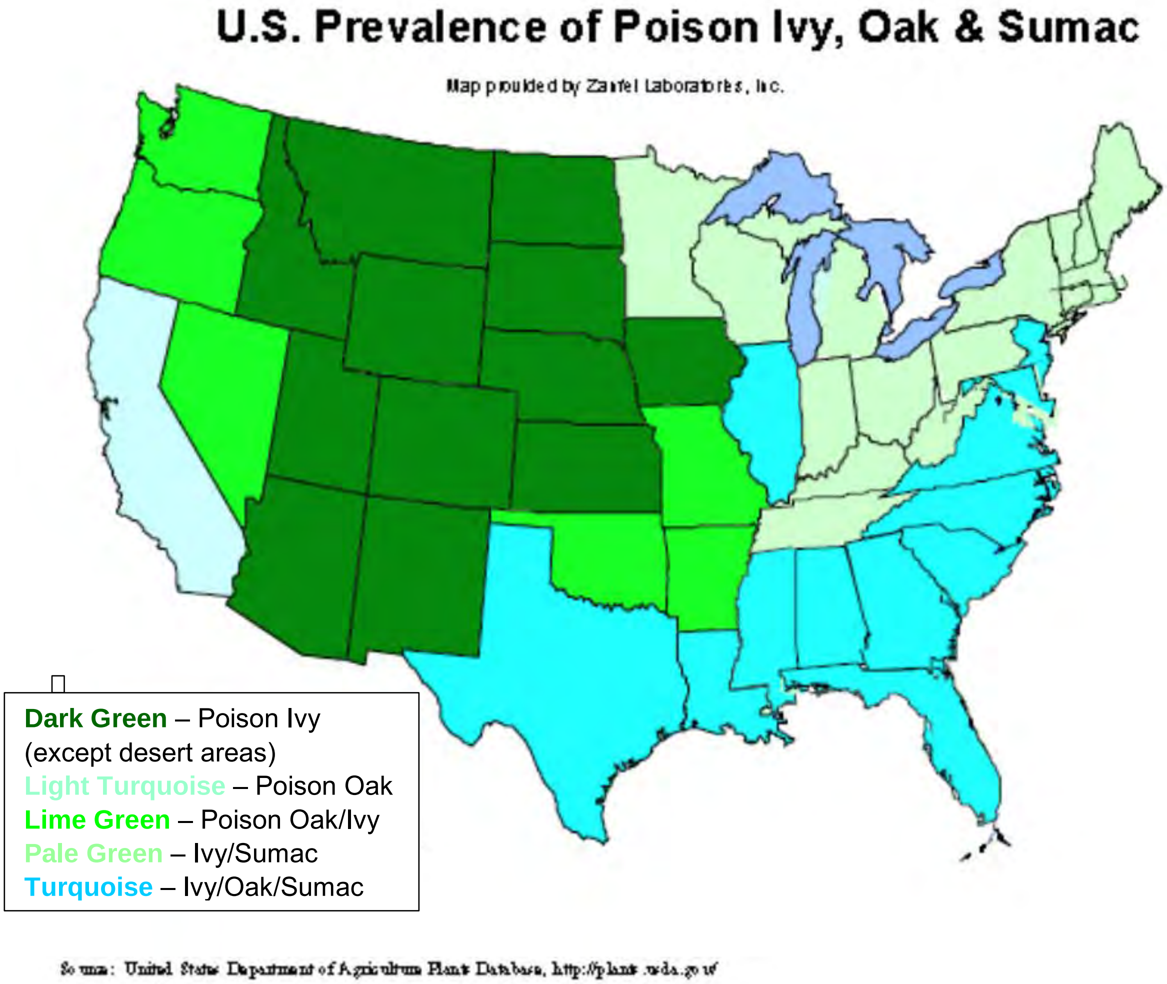
Poison oak can be present as a sparingly branched shrub. Poison oak can grow anywhere in the United States with the exception of Hawaii, Alaska, and some southwest areas that have desert climates. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches.

Keep in mind that for each of these plants,

Poison Oak

Poison Ivy

Poison Sumac



To prevent exposure to these poisonous plants:

- Barrier skin creams, such as lotion containing bentoquatum (Tecnu®), may offer some protection prevent the occurrence of exposure symptoms.
- Wear long sleeves, long pants, boots, and gloves.

Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. Susceptible individuals should identify themselves to the SSO or GEI Project Manager. If you believe you have contacted one of these plants:

- Immediately wash skin thoroughly with soap and water, taking care not to touch your face or other body parts.
- Wash exposed clothing separately in hot water with detergent.
- After use, clean tools, and soles of boots with rubbing alcohol or soap and lots of water. Urushiol can remain active on the surface of objects for up to 5 years.

- If a rash occurs, contact the CHSO and complete and submit an Accident Report Form.

1.2.6 Sewage and Bacterial Impacted Sediments

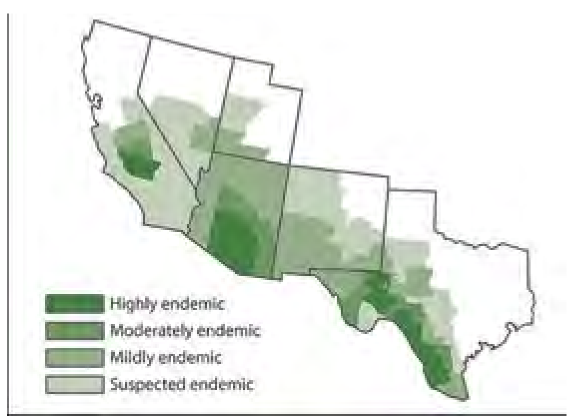
Some project work may be conducted at sites that serve or have served as a combined sewer overflow (CSO) and consequently may have received untreated sanitary sewage from numerous sources. Decomposed sewage can potentially be encountered within sites and their sediments. Sediments could contain soil and marine microorganisms, and bacterium associated with sewage. Many of these bacterium can cause illness through ingestion, direct contact, or the inhalation of a bio-aerosol. Potential respiratory exposure to biological agents can also occur through the inhalation of aerosols produced during sediment handling activities. Personal protective equipment as identified in the site-specific HASP will be worn to minimize potential exposures. Employees will follow the decontamination or disposal procedures identified in the HASP.

1.2.6 Fungal Spores in Soil – Valley Fever

Valley Fever is an illness that usually affects the lungs. It is caused by the fungus Coccidioides immitis that lives in the top 2 to 12 inches of soil in many parts of California. When fungal spores are present, any work activity that disturbs the soil, such as digging, grading or other earth moving operations, or vehicle operation on dirt roads, can cause the spores to become airborne, therefore increasing the risk of Valley Fever. All employees on sites where the fungus is present, and who are exposed to dusty conditions and wind-blown dusts are at increased risk of becoming infected.

Valley Fever fungal spores are too small to be seen, and there is no reliable way to test the soil for spores before working in a particular place. Valley Fever can be found throughout the southwestern United States, parts of Mexico and South America. Some California counties consistently have Valley Fever fungus present in the soil. In these regions Valley Fever is considered endemic. Health departments track the number of cases of Valley Fever illness that occur. This information is used to map illness rates as seen on the figure below.


California county-specific coccidioidomycosis incidence rates, 2011
Merced
Madera
Fresno
Tulare
Kings
San Luis Obispo
Kern
Cases per 100,000 population
0.0
0.1—19.9
20.0—74.9
75.0—304.0
Potentially unreliable rate: relative standard error 23 percent or more
Center for Infectious Diseases - Division of Communicable Disease Control
Infectious Diseases Branch - Surveillance and Statistics Section


Highly endemic
Moderately endemic
Mildly endemic
Suspected endemic

When present, symptoms usually occur between seven to 21 days after breathing in spores, and can include:

- Cough
- Fever
- Chest pain
- Headache
- Muscle aches
- Rash on upper trunk or extremities
- Joint pain in the knees or ankles
- Fatigue

Symptoms of Valley Fever can be mistaken for other diseases such as the flu (influenza) and TB (tuberculosis), so it is important for employees to obtain medical care for an accurate diagnosis and possible treatment.

While there is no vaccine to prevent Valley Fever, the following steps are important to take in order to limit risk:

- Determine if the worksite is in an endemic area. Contact the local health department for more information about the risk in the county GEI is performing work that may disturb soils.
- Prepare work plans and work practices that reduce employee’s exposure, which may include:
    - Provide air conditioned cabs for vehicles that generate heavy dust and make sure employees keep windows and vents closed.
    - Suspend work during heavy winds.
- When exposure to dust is unavoidable, provide National Institute for Occupational Safety and Health (NIOSH)-approved respiratory protection with particulate filters rated as N95, N99, N100, P100, or High Efficiency Particulate Air (HEPA). Employers must develop and implement a respiratory protection program in accordance with California’s Occupational Safety and Health Administration (Cal/OSHA’s) Respiratory Protection standard (8 CCR 5144).
- Take measures to reduce transporting spores off site, such as:
    - Clean tools, equipment, PPE and vehicles before transporting off site.
    - If employee’s clothing is likely to be heavily contaminated with dust, provide coveralls and change rooms, and showers where possible.

1.3 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.4 References

http://www.cdc.gov/ncidod/dvbid/westnile/index.htm
http://www.cdc.gov/ncidod/dvbid/westnile/qa/insect_repellent.htm
http://www.epa.gov/pesticides/health/mosquitoes/insectrp.htm
http://www.cdc.gov/niosh/topics/lyme/
Protecting Yourself From Ticks and Mosquitoes, NIOSH Fast Facts, Publication No. 2010-119
http://npic.orst.edu/pest/mosquito/ptc.html

1.5 Attachments

None

1.6 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-002 Infectious Materials and Bloodborne Pathogens Exposure Control Plan

1.1 Objective

GEI personnel may come in contact with potentially infectious agents when performing first aid or cardiopulmonary resuscitation (CPR). Employees may also come into contact with these materials when working at certain contaminated sites (i.e., urban sites, discarded contaminated needles or sewer outfall exposures). This standard operating procedure (SOP) has been developed to minimize the potential for exposure to employees who may contact, directly or indirectly, infectious agents.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for contact with infection materials and bloodborne pathogens. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with infectious materials or bloodborne pathogens and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

- Universal Precautions (i.e., treat all potentially infectious materials as if it were infected) will be used by GEI employees.

1.3 Exposure Control Plan

1.3.1 Standard Procedures

Sampling of potentially infectious materials will be performed in a manner that minimizes the potential for creating splashes, droplets, or aerosols. Mechanical pipetting devices will be used for manipulating sanitary sewer effluent. Mouth pipetting is prohibited.

The use of glassware or equipment with sharp or pointed edges will be kept at a minimum to reduce the potential of injury that would create a direct route of entry into the body for infectious materials.

Minor cuts, scratches, or other breaks in the skin barrier will be covered prior to the handling of infectious materials. Employees experiencing exudative lesions or weeping dermatitis will refrain from direct contact with infectious materials.

Eating, drinking, smoking, or application of cosmetics is not permitted in areas where potentially infectious materials are handled or sampled.

Employees will wash and disinfect their hands, face, or other potentially contaminated skin surfaces upon completing the handling of infectious or potentially infectious agents or after rendering first aid.

1.3.2 Personal Protective Equipment

Personal Protective Equipment (PPE) will be worn to reduce the potential of exposures to splashes or aerosols. At a minimum, this equipment will include safety glasses and appropriate gloves, but may also require the use of face, respiratory, foot, and full-body protection. Refer to the site-specific Health and Safety Plan for specific PPE requirements.

Gloves used in the handling or sampling of infectious materials will be appropriately disposed of and not reused.

1.3.3 Medical Monitoring

Medical monitoring is required for an employee when a potential workplace exposure has occurred. The employee must notify the Corporate Health and Safety Officer (CHSO) and Human Resources regarding the potential exposure as soon as possible. For infectious agents in which a medically accepted vaccination has been developed (e.g., hepatitis B virus [HBV]) potentially exposed employees will be given the option to receive an inoculation at no cost. Employees who have been exposed will be given the option to receive a confidential medical evaluation at no cost. Required records for exposed employees will be kept confidential.

1.3.4 Training

Employees with a reasonable risk for exposure must attend Bloodborne Pathogen training covering the following topics:

- An explanation of the Occupational Health and Safety Administration (OSHA) bloodborne pathogen standard.
- A general explanation of bloodborne diseases.
- An explanation of the modes of transmission of bloodborne diseases.
- An explanation of the GEI's Bloodborne Pathogen SOP and exposure control plan.
- Appropriate methods for recognizing tasks that involve potential exposure.
- An explanation of the use and limitations of methods to prevent exposure.
- Proper types, use, handling, decontamination, and disposal of PPE.
- The availability of HBV vaccines and the procedures for obtaining a vaccination.
- Appropriate actions to take during an emergency involving bloodborne pathogens.

- Post-exposure procedures.
- An explanation of required signs and labels.

1.4 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.5 Reference

OSHA 29 CFR 1910.1030 - Bloodborne Pathogens.

1.6 Attachments

1.7 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP NO. HS-003 Container Management

1.1 Objective

This standard operating procedure (SOP) has been developed to minimize the potential for injuries to GEI employees performing container and drum handling and sampling, through proper use of engineering and administrative controls, personal protective equipment (PPE), and education.

1.2 General

This SOP is intended for use by employees engaged in work with the management of containers that may contain hazardous substances or contaminated media. The site-specific health and safety plan (HASP) should include a hazard assessment and control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

Hazardous substances and contaminated media will be handled, transported, labeled, and disposed of in accordance with this paragraph. Drums and containers will meet the appropriate United States Department of Transportation (DOT), Occupational Safety and Health Administration (OSHA), and Environmental Protection Agency (EPA) regulations for the wastes that they contain.

Site operations will be organized to minimize the amount of drum or container movement. Prior to movement of drums or containers, employees exposed to the transfer operation will be notified of the potential hazards associated with the contents of the drums or containers. Unlabeled drums and containers will be considered to contain hazardous substances and handled accordingly until the contents are positively identified and labeled.

DOT specified salvage drums or containers and suitable quantities of proper absorbent will be kept available and used in areas where spills, leaks, or ruptures may occur. Where spills may occur, a spill containment program, which may be part of the HASP, will be implemented to contain and isolate the entire volume of the hazardous substance being transferred.

1.3 Opening Drums and Containers

The following procedures will be followed in areas where drums or containers are being opened:

- Employees not actually involved in opening drums or containers will be kept a safe distance from the drums or containers being opened.

- If employees must work near or adjacent to drums or containers being opened, a suitable shield that does not interfere with the work operation will be placed between the employee and the drums or containers being opened to protect the employee in case of accidental release.

- GEI employees will not handle or attempt to open bulging containers. Employees will not stand upon or work from drums or containers. GEI will contract with a hazardous waste company to handle, manage, and dispose of a bulging drum.

1.4 Material Handling Equipment

Material handling equipment, such as drum dollies, used to transfer drums and containers will be selected, positioned, and operated to minimize sources of ignition.

1.5 Radioactive Wastes

GEI does not routinely handle or manage radioactive waste. If required to do so for a project, procedures will be approved by the Corporate Health and Safety Officer (CHSO) and Regional Health and Safety Officer (RHSO).

1.6 Shock-Sensitive Wastes

GEI employees will not handle shock-sensitive waste. Shock-sensitive waste or chemicals may explode with friction, movement or heat. Some chemicals are shock-sensitive by nature-, others become shock-sensitive through drying, decomposition, or slow reactions with oxygen, nitrogen, or the container. Some chemicals that are, or can, become shock-sensitive will have that hazard noted in the safety data sheet (SDS).

- Drums and containers containing packaged laboratory wastes will be considered to contain shock-sensitive or explosive materials until they have been characterized. *Caution: Shipping of shock-sensitive wastes may be prohibited under U.S. Department of Transportation regulations. Shippers will refer to 49 CFR 173.21 and 173.50*.

1.7 Laboratory Waste Packs

GEI employees will not handle or open laboratory waste packs.

1.8 Sampling of Drum and Container Contents

Sampling of containers and drums will be done in accordance with a site-specific sampling plan that will be developed in conjunction with a site-specific HASP.

1.9 Staging Areas

Drums and containers will be identified and classified prior to packaging for shipment. Drum or container staging areas will be kept to a minimum number as approved by the client to safely identify and classify materials and prepare them for transport. Staging areas will be provided with adequate access and egress routes. Bulking of hazardous wastes will be permitted only after a thorough characterization of the materials has been completed and approved by the Client. GEI employees will not sign manifests unless a written authorization agreement is in place with the Client.

1.10 Tank and Vault Procedures

GEI employees do not routinely sample vaults and tanks. Entry procedures will be coordinated and approved by the CHSO and RHSO.

1.11 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.12 References

OSHA 1910.120 Hazardous Waste Operations and Emergency Response (j) Handling of Drums and Containers.

1.13 Attachments

None

1.14 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURE

HS-004 Driver Safety

1.1 Objective

GEI has implemented a Safe Driving Program to encourage safe driving habits and promote the ongoing safety of our staff and the communities where we work. For more information, refer to the Operation of Vehicles section of GEI's Employee Handbook.

This standard operating procedure (SOP) provides requirements and recommendations to minimize the potential risks while operating or riding in a motor vehicle.

1.2 General

GEI employees will adhere to the following requirements when operating a vehicle while conducting business on behalf of GEI. These requirements apply to GEI owned, rental, and personal vehicles used to conduct GEI business:

- Employees must maintain a valid and current driver's license.
- Employees using a personal vehicle for work-related travel must have proper insurance coverage that meets the requirements in the state in which they reside.
- Employees must wear their safety belt while in a moving vehicle.
- Vehicle accidents will be reported in accordance with GEI's accident reporting procedures. .
- Vehicles will be properly maintained and safely operated (refer to GEI's Fleet Maintenance Program).
- Employees will follow safe driving behaviors, which include limiting distractions such as manipulating radios or other equipment that may cause a distraction. Employees should not exceed the posted speed limit and should maintain a safe distance between other vehicles.
- When parking a vehicle at a job site, the employee should position the vehicle in a manner to reduce or eliminate the need to operate the vehicle in reverse. A safety cone should be placed at the rear of the vehicle after parking the vehicle and be removed prior to moving the vehicle. This procedure makes the employee aware of other vehicles, equipment, and structures within the backup radius of the vehicle.

When driving a rental vehicle or GEI vehicle that you are unfamiliar with orient yourself to the vehicle by:

- Walking around the vehicle to observe the condition of the vehicle and hazards that could be within the travel path.
- Becoming familiar with the size of the vehicle.

- Adjusting mirrors (rear and side).
- Becoming familiar with dashboard, center console, and steering controls.
- Locating the turn signals, windshield wipers, lights, emergency flashers, and the heating, air conditioning, and defrost controls.

1.3 Driving Defensively

Driving defensively means not only taking responsibility for yourself and your actions but also keeping an eye on "the other guy." Good defensive drivers may be able to anticipate what the other driver will do next. GEI recommends the following guidelines to help reduce your risks on the road.

Do not start the vehicle until each passenger and their belongings are secured in the vehicle.

- Remember that driving above or below the speed limit can increase the likelihood of a collision.
- If you notice that a car is straddling the center line, weaving, making wide turns, stopping abruptly or responding slowly to traffic signals, the driver may be impaired or using a cellular telephone.
- Avoid an impaired driver by turning right at the nearest corner or exiting at the nearest exit. If it appears that an oncoming car is crossing into your lane, pull over to the roadside, sound the horn and flash your lights.
- Notify the police if you observe motorist who is driving suspiciously.
- Follow the rules of the road. Do not contest the "right of way" or try to race another car during a merge. Be respectful of other motorists.
- Allow large vehicles, including tractor trailers, extra breaking distance, turning radius, and avoid traveling in their blind spots.
- Do not follow too closely. GEI employees should use a "three-second following distance" or a "three-second plus following distance."
- While driving be cautious, aware, and responsible.
- Use extra caution and reduce speed in construction areas and school zones.
- Be aware of pedestrians, bicyclists, and motorcyclists.

1.4 Cellular Phone Use and Other Distractions

Refer to the Human Resources policy on use of cellular telephones while operating a vehicle on company business.

1.5 Drugs and Alcohol

The use of illegal drugs or alcohol is prohibited when driving a vehicle on GEI business. Be aware of the side effects of prescription and over-the-counter medications which can impair an employee’s ability to drive.

1.6 Adverse Driving Conditions

1.6.1 Driving at Night

Vision maybe limited at night due to impairment of the driver's depth perception, color recognition, and peripheral vision. Another factor adding danger to night or early morning driving is fatigue. Drowsiness makes driving more difficult by dulling concentration and slowing reaction time.

Effective measures to minimize these hazards by preparing your car and following guidelines:

- Have your headlights properly aimed. Misaimed headlights blind other drivers and reduce your ability to see the road.
- Alcohol severely impairs your driving ability and acts as a depressant.
- Avoid smoking when you drive. Smoke's nicotine and carbon monoxide hamper night vision.
- Lights will not help the driver see better in early twilight, but they will make it easier for other drivers to see you. Do not overdrive your headlights. You should be able to stop inside the illuminated area. If you do not, you create a blind crash area in front of your vehicle.
- If an oncoming vehicle does not lower beams from high to low, avoid glare by watching the right edge of the road and using it as a steering guide.
- Make frequent stops for light snacks and exercise. If you are too tired to drive, stop in a safe area and get some rest.
- Observe driving safety as soon as the sun goes down. Twilight is one of the most difficult times to drive, because your eyes are constantly changing to adapt to the growing darkness.

1.6.2 Snow/Freezing Conditions

When snow and ice are present, be prepared by following these winter driving safety tips.

1.6.2.1 Prepare the Vehicle Before a Snowstorm

- Check under the hood and take a look at the vehicles cooling system. Make sure the vehicle contains adequate antifreeze and the hoses are in good condition.
- Test heaters and defrosters ahead of time to make sure they are in good working condition.
- Test your windshield wipers and check the condition of your wiper blades. If wipers leave streaks on your windshields, replace the blades.
- It is recommended that a windshield washer/antifreeze solution is used during winter conditions.
- Check your lights and periodically clear them of snow and dirt.
- Car batteries need extra power in cold conditions. Make sure the battery's terminals are clean and cables are secure.

- Keep your gas tank at least half full in the winter to help avoid gas line freeze up.

1.6.2.2 Driving During and After a Snowstorm

- Wear sunglasses to aid in limiting reflection from snow.
- Be aware of blind spots created by snow banks.
- Be extra cautious of pedestrians and other vehicles in intersections.
- Allow extra time for braking and increase the distance between you and the car ahead of you.
- Reduce your speed and do not exceed the posted limit.
- If you start to lose traction take your foot off the gas and gradually reduce your speed. Accelerate slowly once you feel traction is regained.
- If you start to skid, steer in the direction of the skid. Remember, steering can be more important than braking on slippery roads.

1.6.3 Driving In the Rain

To prevent losing control of your car on wet pavement, take these preventive measures.

- Prevent skids by driving slowly and carefully, especially on curves.
- Steer and brake with a light touch.
- When you need to stop or slow, do not brake hard or lock the wheels.
- Maintain mild pressure on the brake pedal.

If you skid, ease your foot off the gas, and carefully steer in the direction you want the front of the car to go. For cars without anti-lock brakes, avoid using your brakes. This procedure, known as "steering into the skid," will bring the back end of the car in line with the front. If your car has anti-lock brake systems (ABS), brake firmly as you "steer into the skid."

Hydroplaning happens when the water in front of your tires builds up faster than your car's weight can push it out of the way. The water pressure causes your car to lose contact with the road surface and slide on a thin layer of water between your tires and the road. At this point, your car can be completely out of contact with the road, and you are in danger of skidding or drifting out of your lane, or even off the road.

To avoid hydroplaning, keep the tires properly inflated and maintain good tread on the tires. If tires need to be replaced on a company vehicle, notify the branch manager or their designee. Slow down when roads are wet, and stay away from puddles. Try to drive in the tire tracks left by the cars in front of you. If you begin to hydroplane, do not brake or turn suddenly. This could throw your car into a skid. Ease your foot off the gas until the car slows and you can feel the road again. If you need to brake, do it gently with light pumping actions. If your car has ABS, then brake normally; the car's computer will mimic a pumping action, when necessary.

If weather conditions worsen to the point where the driver is not comfortable driving, pull the vehicle over to a safe location until conditions improve. Do not drive during severe weather conditions. Do not attempt to drive on roads with standing water or that have been flooded. Find an alternate route if these conditions exist.

1.6.4 Off Road

If operation of a vehicle is required off publicly or privately maintained roads or in situations where four-wheel-drive vehicles are required, the appropriate vehicle for the situation will be used.

1.7 Driver Training

GEI employees are required to complete driver safety training every 3 years. Employees will complete the examination at the end of each module and forward the training certificate to Human Resources.

1.8 Limitations

Follow safety procedures as defined in the site-specific HASP.

1.9 References

National Safety Council
Oklahoma Safety Council
GEI Consultants, Inc. Employee Handbook

1.10 Attachments

1.11 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-006 Excavations and Trenches

1.1 Objective

GEI employees may be involved with projects that include some type of excavation and trenching as part of the work activities. The following guidelines will be followed when excavations or trenches are present on GEI projects.

1.2 General

This standard operating procedure (SOP) is intended for use by employees engaged in work on project sites that include trenching and/or excavation operations. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for trenching and excavation hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

Hazards associated with excavations and trenches can include collapse, falls, falling objects, hazardous atmospheres, and incidents involving mobile equipment.

GEI employees will not enter trenches or excavations that do not comply with OSHA 29 CFR 1926.650. If a project requires GEI employees to enter a trench or excavation, the trench or excavation should meet the following requirements:

- The excavation must be inspected daily by a competent person to identify potential hazards associated with the excavation. GEI generally does not act as the competent person.
- A protective system should be in place for trenches or excavations greater than 5- feet in depth.
- Employees will be protected from vehicular traffic by the use of barricades, cones and tape or other physical barriers.
- The protective system should be designed based on soil type, depth of excavation, water level, loads adjacent to the excavation, changes in weather conditions, or other operations in the area. Protective systems can include sloping or benching of the sidewalls, shoring the sidewalls using an approved support system, or shielding workers with a trench box or other similar type of support.
- If the excavation is greater than 20-feet in depth, the protection system requires a design by a registered professional engineer or based on tabulated data prepared and/or approved by a registered professional engineer.

- Excavations and trenches greater than four feet in depth require a safe access and egress including ladders, steps, or ramps. These points of access and egress are to be no greater than 25 feet of lateral travel in any direction.

- Where oxygen deficiency (atmospheres containing less than 20.7 percent oxygen) or a hazardous atmosphere exists or could reasonably be expected to exist, such as in excavations in landfill areas or excavations in areas where hazardous substances are stored nearby, the atmospheres in the excavation shall be tested before employees enter excavations greater than four feet in depth.

When GEI is subcontracting the excavation activities:

- Care should be taken not to create new hazards like narrow walkways along edges of an excavation.
- Heavy equipment should not be parked or working at the edge of the excavation.
- Spoils should not be stockpiled within 2 feet of the trench edges.
- Confirm with subcontractor that underground utilities have been located before any excavation or trenching activities begin (refer to SOP HS-014 Utility Mark-out).
- When required guardrails will be installed for crossings and walkways to provide fall protection.
- Confirm with the subcontractor that the excavation or trench has been tested for hazardous atmospheres before entering.
- Confirm with the subcontractor that the excavation or trench has been inspected by a competent person before each work shift and after any type of precipitation. Water should be directed away from the excavation or trench whenever possible. If hazards are identified during this inspection, verify that the hazards are controlled prior to entering the trench or excavation.
- GEI employees will not work under raised or suspended loads.

In circumstances where GEI employees are working on sites where a contractual agreement with the excavation contractor does not exist and we cannot confirm the above stated conditions, entry into trenches or excavations should not be conducted.

1.3 Soil Classifications

The soil classification system means a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability.

1) Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

2. Type A means cohesive soils with an unconfined, compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

a) The soil is fissured; or

b) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

c) The soil has been previously disturbed; or

d) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

e) The material is subject to other factors that would require it to be classified as a less stable material.

3) Type B means:

a) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

b) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

c) Previously disturbed soils except those which would otherwise be classed as Type C soil.

d) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

e) Dry rock that is not stable; or

f) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

4) Type C means:

a) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

b) Granular soils including gravel, sand, and loamy sand; or

c) Submerged soil or soil from which water is freely seeping; or

d) Submerged rock that is not stable, or

e) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Where soils are configured in layers, i.e., where a layered geologic structure exists, the soil must be classified on the basis of the soil classification of the weakest soil layer. Each layer may be classified individually if a more stable layer lies below a less stable layer, i.e., where a Type C soil rests on top of stable rock.

1.4 GEI Requirements for the Excavation/Trenches Competent Person

Although GEI does not normally act as the competent person for excavations and trenches this person should have and be able to demonstrate the following:

- Training, experience, and knowledge of:
  - soil analysis;
  - use of protective systems; and
  - requirements of 29 CFR Part 1926 Subpart P.
- Ability to detect:
  - conditions that could result in cave-ins;
  - failures in protective systems;
  - hazardous atmospheres; and
  - other hazards including those associated with confined spaces.
- Authority to take prompt corrective measures to eliminate existing and predictable hazards and to stop work when required.

1.5 Test Equipment And Methods For Evaluating Soil Type

Many kinds of equipment and methods are used to determine the type of soil prevailing in an area, as described below.

A. Pocket Penetrometer. Penetrometers are direct-reading, spring-operated instruments used to determine the unconfined compressive strength of saturated cohesive soils. Once pushed into the soil, an indicator sleeve displays the reading. The instrument is calibrated in either tons per square foot (tsf) or kilograms per square centimeter (kPa). However, Penetrometers have error rates in the range of ± 20-40%.
   1. Shearvane (Torvane). To determine the unconfined compressive strength of the soil with a shearvane, the blades of the vane are pressed into a level section of undisturbed soil, and the torsional knob is slowly turned until soil failure occurs. The direct instrument reading must be multiplied by 2 to provide results in tons per square foot (tsf) or kilograms per square centimeter (kPa).

2. Thumb Penetration Test. The thumb penetration procedure involves an attempt to press the thumb firmly into the soil in question. If the thumb makes an indentation in the soil only with great difficulty, the soil is probably Type A. If the thumb penetrates no further than the length of the thumb nail, it is probably Type B soil, and if the thumb penetrates the full length of the thumb, it is Type C soil. The thumb test is subjective and is therefore the least accurate of the three methods.
3. Dry Strength Test. Dry soil that crumbles freely or with moderate pressure into individual grains is granular. Dry soil that falls into clumps that subsequently break into smaller clumps (and the smaller clumps can be broken only with difficulty) is probably clay in combination with gravel, sand, or silt. If the soil breaks into clumps that do not break into smaller clumps (and the soil can be broken only with difficulty), the soil is considered unfissured unless there is visual indication of fissuring.

B. Plasticity or Wet Thread Test. This test is conducted by molding a moist sample of the soil into a ball and attempting to roll it into a thin thread approximately 1/8 inch (3 mm) in diameter (thick) by 2 inches (50 mm) in length. The soil sample is held by one end. If the sample does not break or tear, the soil is considered cohesive.

C. Visual Test. A visual test is a qualitative evaluation of conditions around the site. In a visual test, the entire excavation site is observed, including the soil adjacent to the site and the soil being excavated. If the soil remains in clumps, it is cohesive; if it appears to be coarse-grained sand or gravel, it is considered granular. The evaluator also checks for any signs of vibration.

During a visual test, the evaluator should check for crack-line openings along the failure zone that would indicate tension cracks, look for existing utilities that indicate that the soil has previously been disturbed, and observe the open side of the excavation for indications of layered geologic structuring.

The evaluator should also look for signs of bulging, boiling, or sluffing, as well as for signs of surface water seeping from the sides of the excavation or from the water table. If there is standing water in the cut, the evaluator should check for "quick" conditions. In addition, the area adjacent to the excavation should be checked for signs of foundations or other intrusions into the failure zone, and the evaluator should check for surcharging and the spoil distance from the edge of the excavation.

1.6 Shoring Types

Shoring is the provision of a support system for trench faces used to prevent movement of soil, underground utilities, roadways, and foundations. Shoring or shielding is used when the location or depth of the cut makes sloping back to the maximum allowable slope impractical. Shoring systems consist of posts, wales, struts, and sheeting. There are two basic types of shoring, timber and aluminum hydraulic.

Hydraulic shoring can be a prefabricated strut and/or wale system manufactured of aluminum or steel. Hydraulic shoring provides a critical safety advantage over timber shoring because workers do not have to enter the trench to install or remove hydraulic shoring. Other advantages of most hydraulic systems are that they:

- Are light enough to be installed by one worker;
- Are gauge-regulated to ensure even distribution of pressure along the trench line;
- Can have their trench faces "preloaded" to use the soil's natural cohesion to prevent movement; and
- Can be adapted easily to various trench depths and widths.

All shoring should be installed from the top down and removed from the bottom up. Hydraulic shoring should be checked at least once per shift for leaking hoses and/or cylinders, broken connections, cracked nipples, bent bases, and any other damaged or defective parts.

Pneumatic Shoring works in a manner similar to hydraulic shoring. The primary difference is that pneumatic shoring uses air pressure in place of hydraulic pressure. A disadvantage to the use of pneumatic shoring is that an air compressor must be on site.

- Screw jack systems differ from hydraulic and pneumatic systems in that the struts of a screw jack system must be adjusted manually. This creates a hazard because the worker is required to be in the trench in order to adjust the strut. In addition, uniform "preloading" cannot be achieved with screw jacks, and their weight creates handling difficulties.
- Single-Cylinder Hydraulic Shores. Shores of this type are generally used in a water system, as an assist to timber shoring systems, and in shallow trenches where face stability is required.
- Underpinning. This process involves stabilizing adjacent structures, foundations, and other intrusions that may have an impact on the excavation. As the term indicates, underpinning is a procedure in which the foundation is physically reinforced. Underpinning should be conducted only under the direction and with the approval of a registered professional engineer.

1.7 Shielding Types

Trench Boxes are different from shoring because, instead of shoring up or otherwise supporting the trench face, they are intended primarily to protect workers from cave-ins and similar incidents. The excavated area between the outside of the trench box and the face of the trench should be as small as possible. The space between the trench boxes and the excavation side are backfilled to prevent lateral movement of the box. Shields may not be subjected to loads exceeding those which the system was designed to withstand.

Trench boxes are generally used in open areas, but they also may be used in combination with sloping and benching. The box should extend at least 18 in (0.45 m) above the surrounding area if there is sloping toward excavation. This can be accomplished by providing a benched area adjacent to the box.

Earth excavation to a depth of 2 ft (0.61 m) below the shield is permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench and there are no indications while the trench is open of possible loss of soil from behind or below the bottom of the support system. Conditions of this type require observation on the effects of bulging, heaving, and boiling as well as surcharging, vibration, adjacent structures, etc., on excavating below the bottom of a shield. Careful visual inspection of the conditions mentioned above is the primary and most prudent approach to hazard identification and control.

1.8 Sloping And Benching

Maximum allowable slopes for excavations less than 20 ft (6.09 m) based on soil type and angle to the horizontal are as follows:

Soil type	height/Depth ratio	Slope angle
Stable Rock	Vertical	90°
Type A	¾:1	53°
Type B	1:1	45°
Type C	1½:1	34°
Type A (short-term)	½:1	63°
(For a maximum excavation depth of 12 ft)		

-

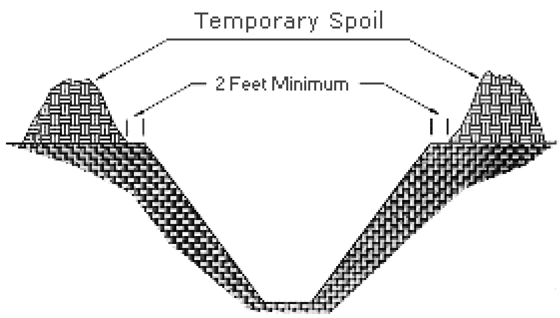
There are two basic types of benching, simple and multiple. The type of soil determines the horizontal to vertical ratio of the benched side.

As a general rule, the bottom vertical height of the trench must not exceed 4 ft (1.2 m) for the first bench. Subsequent benches may be up to a maximum of 5 ft (1.5 m) vertical in Type A soil and 4 ft (1.2 m) in Type B soil to a total trench depth of 20 ft (6.0 m). All subsequent benches must be below the maximum allowable slope for that soil type. For Type B soil the trench excavation is permitted in cohesive soil only.

1.9 Spoil

Temporary spoil must be placed no closer than 2 ft (0.61 m) from the surface edge of the excavation, measured from the nearest base of the spoil to the cut. This distance should not be measured from the crown of the spoil deposit. This distance requirement ensures that loose rock or soil from the temporary spoil will not fall on employees in the trench.

Spoil should be placed so that it channels rainwater and other run-off water away from the excavation. Spoil should be placed so that it cannot accidentally run, slide, or fall back into the excavation.



Permanent spoil should be placed at some distance from the excavation. Permanent spoil is often created where underpasses are built or utilities are buried. The improper placement of permanent spoil, i.e. insufficient distance from the working excavation, can cause an excavation to be out of compliance with the horizontal-to-vertical ratio requirement for a particular excavation. This can usually be determined through visual observation. Permanent spoil can change undisturbed soil to disturbed soil and dramatically alter slope requirements.

1.10 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

Do not enter a trench or excavation without consulting with the project manager, Corporate Health and Safety Officer (CHSO), or Regional Health and Safety Officer (RHSO).

Some states, including Massachusetts, require a trench permit prior to trenching or excavation activities. Verification of local requirements will be evaluated in the planning stage.

1.11 References

OSHA 29 CFR 1926.650 – Subpart P; *Excavations.*
OSHA Construction eTool - http://www.osha.gov/SLTC/etools/construction/index.html
OSHA Technical Manual (OTM), Section V: Chapter 2 - Excavations: Hazard Recognition In Trenching And Shoring

1.12 Attachments

None

1.13 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

HS-007 General Safety Requirements

1.1 Objective

GEI is committed to providing its employees with a safe and healthy work environment. To maintain a safe work environment, GEI has established general safety requirements to promote safe work practices.

1.2 General Health and Safety Training

GEI requires employees to complete Health and Safety Training on an annual basis. Project employees must have completed, at a minimum, GEI's General 4-Hour Health and Safety Training or when required, HAZWOPER training before beginning on-site work activities. In addition, field staff must be current in First Aid and CPR Training. Site-specific safety training will also be completed before beginning work on each project site. Further Health and Safety training requirements can be found in Section 2 of the GEI Health and Safety Manual.

1.3 Tailgate Meetings

Health and Safety tailgate meetings will be conducted by the GEI Project Manager or Site Safety Officer (SSO), and be recorded in the GEI field book or on the GEI daily safety briefing log. Employees on-site will sign the daily safety briefing log to indicate attendance.

1.4 Health and Safety Plans

GEI projects must have a health and safety plan (HASP) before beginning site work. GEI HASP templates are located on the Health and Safety page on the GEI intranet. Specific requirements for HASPs are located in Section 7 of GEI's Health and Safety Manual. After the HASP has been completed, it must be sent to the Corporate Health and Safety Officer (CHSO) and the Regional Health and Safety Officer (RHSO) for review. Project employees must read the HASP and sign the signature page to document that they have read, understood, and will comply with the requirements of the HASP. The site-specific HASP must be kept on-site at all times.

1.5 Personal Protective Equipment

Project-specific personal protective equipment (PPE) will be identified in the HASP based on the hazards present during work tasks. Required PPE must be worn on the project site. More information regarding PPE is located in Section 6 of GEI's Health and Safety Manual.

1.6 Fire Protection and Prevention

The work site should be kept clear of flammable materials and debris. GEI field personnel should know where fire extinguishers are located, and be familiar in the use of the extinguisher. Information on the correct use of a fire extinguisher is included in GEI's general health and safety training. Call 911(or other number identified in the project HASP) in the event of a fire.

1.7 Accident/Incident Reporting

The following accident reporting procedures must be followed:

- Seek medical attention.
- Notify your supervisor.
- Notify CHSO and Human Resources (HR) within two hours of the accident/incident.
- Complete Accident Reporting Form (found on the Health and Safety page of the GEI Intranet or on the GEI App) within **24 hours** and send to the CHSO and Human Resources. Refer to Section 8 of the GEI Health and Safety Manual for more information.

1.8 Near Miss Reporting

GEI employees will complete a near-miss reporting form if a hazardous or unsafe condition or near miss is observed. The near-miss reporting form is located on the Health and Safety page of the GEI Intranet. Refer to Section 8 of the GEI Health and Safety Manual for more information.

1.9 Housekeeping

Work areas, passages, and stairs will be kept clear of debris. Debris will be removed from the project site at regular intervals.

1.10 Illumination

Project sites will be illuminated either with natural or artificial illumination, in compliance with OSHA regulations.

1.11 Sanitation

Hand-washing is an essential form of protection from chemical and biological exposures and illness. GEI employees should wash their hands after performing work tasks and regularly throughout the day. If soap and water are not available, hand sanitizers and/or wipes should be used.

1.12 Machinery, Tools, Material, and Equipment

Machinery, tools, material, and equipment will be kept in good working condition and will be inspected by a competent person. Unsafe equipment will be identified as unsafe by tagging or locking the controls to render them inoperable. Arrangements will be made to repair or dispose of damaged or unsafe equipment.

1.13 Vehicles

GEI's motor vehicles will be maintained in accordance with the GEI fleet maintenance program. Each GEI-owned vehicle will have a fire extinguisher and first aid kit. Additional fire extinguishers and first aid kits are kept in each GEI office for use in personal or rental vehicles.

1.14 Heavy Equipment

GEI employees will keep a line of sight between them and heavy equipment operators. If a GEI employee needs to communicate with heavy equipment operators, they will use hand signals or direct communication with the operator. GEI employees should not:

- Operate or climb on heavy equipment
- Approach heavy equipment while it is in operation.
- Use cellular telephones when working near operating equipment.

For more information regarding heavy equipment, refer to GEI's SOP HS-018 Heavy Equipment.

1.15 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.16 Attachments

None

1.17 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer

GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP NO. HS-009 Hazardous Substances Management

1.1 Objective

This Standard Operating Procedure (SOP) is intended to outline the steps GEI employees will take to identify potential hazards associated with exposure to hazardous substances, the risks associated with these hazards, and the proper controls to use to minimize exposure. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with biological hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

1.2 Hazard Identification

An initial identification of hazards should be done based on a review of available documents including lists of chemicals used on site, analytical data from soil, surface water, groundwater, air, spill history, site history, equipment on site, maps, photos, and a preliminary survey.

1.3 Risk Identification

Once the presence and concentrations of specific hazardous substances and health hazards have been established, the risks associated with these substances will be identified. GEI employees and GEI subcontractors who will be working on the site will be informed of risks that have been identified.

Risks to consider include, but are not limited to:

- Potential exposures exceeding the permissible exposure limits and published exposure levels.
- Potential Immediately to Life and Health (IDLH) Concentrations.
- Potential Skin Absorption and Irritation Sources.
- Potential Eye Irritation Sources.
- Potential hazardous atmospheres, including oxygen deficiency and fire and explosion hazards.

1.4 Engineering Controls, Work Practices, and Personal Protective Equipment for Employee Protection

Engineering controls, work practices, and personnel protective equipment (PPE) for substances regulated in OSHA Subpart Z (Toxic and Hazardous Substances) will be implemented in accordance with this section to protect employees from exposure to hazardous substances and safety and health hazards.

1.4.1 Engineering Controls, Work Practices, and Personal Protective Equipment for Substances Regulated in Subparts G (Occupational Health and Environment Control) and Subpart Z (Toxic and Hazardous Substances)

Engineering controls and work practices will be instituted to reduce and maintain employee exposure at or below the permissible exposure limits for substances regulated by 29 CFR Part 1910.

Engineering controls that may be feasible include the use of pressurized cabs or control booths on equipment, and/or the use of remotely operated material handling equipment. Work practices may include removing non-essential employees from potential exposure during opening of drums, wetting down dusty operations, and positioning employees upwind of potential hazards.

If engineering controls and work practices are not feasible, or not required, a reasonable combination of engineering controls, work practices, and PPE will be used to reduce and maintain at or below the permissible exposure limits or dose limits for substances regulated by 29 CFR Part 1910, Subpart Z.

GEI will not implement a schedule of employee rotation as a means of compliance with permissible exposure limits or dose limits except when there is no other feasible way of complying with the airborne or dermal dose limits for ionizing radiation.

The provisions of 29 CFR, subpart G, Occupational Health and Environment control, will be followed.

1.4.2 Engineering Controls, Work Practices, and Personal Protective Equipment for Substances Not Regulated in Subparts G and Subparts Z

An appropriate combination of engineering controls, work practices, and personal protective equipment will be used to reduce and maintain employee exposure to or below published exposure levels for hazardous substances and health hazards not regulated by 29 CFR Part 1910, Subparts G and Subparts Z. GEI will use published literature and Safety Data Sheet (SDS) as a guide in making the determination of what level of protection is appropriate for hazardous substances and health hazards for which there is no permissible exposure limit or published exposure limit.

1.4.3 Decontamination Procedure

Decontamination procedure(s) will be developed, communicated to employees, and implemented before employees or equipment enter areas on site where potential for exposure to hazardous substances exists. Procedures will be developed to minimize employee contact with hazardous substances or with equipment that has contacted hazardous substances.

GEI employees leaving a contaminated area will be properly decontaminated; contaminated clothing and equipment leaving a contaminated area will be properly disposed of or decontaminated.

Decontamination procedures will be monitored by the site safety officer (SSO) to determine their effectiveness. When such procedures are found to be ineffective, the site safety officer will contact the CHSO and appropriate steps will be taken to correct deficiencies.

1.4.3.1 Location

Decontamination will be performed in areas that will minimize the exposure to employees, equipment, and the environment.

1.4.3.2 Equipment and Solvents

Equipment and solvents used for decontamination will be decontaminated or disposed of properly.

1.4.3.3 Personal Protective Clothing and Equipment

Protective clothing and equipment will be decontaminated, cleaned, laundered, maintained or replaced as needed to maintain their effectiveness.

Employees whose clothing comes in contact with hazardous substances will immediately remove that clothing and rinse the exposed area with water. The clothing will be disposed of or decontaminated before it is removed from the work zone.

1.4.3.4 Commercial Laundries or Cleaning Establishments

Commercial laundries or cleaning establishments that decontaminate protective clothing or equipment will be informed of the potentially harmful effects of exposures to hazardous substances.

1.4.3.5 Showers and Changing Rooms

Where the decontamination procedure indicates a need for regular showers and change rooms outside of a contaminated area, they will be provided and meet the requirements of

29 CFR 1910.141 (Sanitation). If temperature conditions prevent the effective use of water, then other effective means for cleansing will be provided and used.

1.5 Limitations

None

1.6 Attachments

None

1.7 References

OSHA 1910.120 Hazardous Waste Operations and Emergency Response
OSHA 1910 Subpart G Occupational Health and Environment Control
OSHA 1910 Subpart Z Toxic and Hazardous Substances
OSHA 1910.141 General Environmental Controls - Sanitation

1.8 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-010 Inclement Weather

1.1 Objective

Inclement weather can affect work activities and pose safety hazards to employees working in these conditions. The following guidelines will be followed when weather conditions become a safety concern.

1.2 General

This standard operating procedure (SOP) is intended for use by employees engaged in work with the potential to be affected by inclement weather. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for encounters with biological hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

Employees should be aware of local weather conditions and monitor advisories issued by the National Weather Service and other local reporting services. Depending on location and season, storms are capable of producing heavy rain, floods, extreme temperatures, high wind conditions, lighting, tornados, and/or snowfall.

1.2.1 Heavy Rain

If working or driving in a storm use extreme caution. When driving, turn your lights on when the rainfall becomes heavy. Employees should be aware of the following:

- Heavy rain decreases visibility, especially when driving.
- Surfaces and tools become slippery.
- If you are working in the rain and your clothes become wet there is a risk of hypothermia when exposed to winds, even in warm temperatures.
- If the storms are going to produce thunder and/or lightning, leave the work area immediately and move to a safe area.
- Use your best judgment to determine if the rainfall becomes too heavy to continue working safely.

1.2.2 Lightning

Lightning can strike as far as 10 miles from the area where it is raining. That's about the distance you can hear thunder. **If you can hear thunder, you are within striking distance. Seek safe shelter immediately.** This can be within a building or vehicle. Wait 30 minutes after the last clap of thunder or flash of lightning before going outside again.

1.2.3 Flooding

Flooding may occur as a result of heavy rain in a short period of time. Flooding can be particularly acute in canyon areas where dry creek beds can turn into raging rivers from rainfall in distant or higher elevation areas. Be aware of this and your surroundings and move to a safe place if you begin to see signs that flooding may occur. Do not attempt to drive through areas or streets that are flooded. Seek alternate routes. Be particularly cautious at night when flooded areas are difficult to see. Urban flooding can stop traffic and increase the potential for traffic accidents and becoming trapped in vehicles.

1.2.4 Extreme Temperatures

Work activities may take place in extreme heat or cold. Be prepared if these conditions are anticipated. Have the appropriate personal protective equipment (PPE) available, exercise proper fluid intake, and take breaks to prevent heat and cold stress. For more information about these conditions see the heat stress and cold stress programs found in GEI's Health and Safety Manual.

1.2.5 High Wind and Tornados

Tropical storms are described as storms with sustained winds ranging from 39 to 73 miles per hour (mph) and hurricanes produce sustained winds that exceed 74 mph. When winds approach 40 mph (gale force winds) twigs begin to break off of trees and vehicles will veer off of the road. When winds approach **40 mph** or the GEI employee feels unsafe based on the activities being performed, stop work and seek shelter as soon as possible. Blowing or falling debris and overhanging limbs/signs can be a significant hazard. If possible, avoid driving in these conditions; 70 percent of injuries during hurricanes are a result of vehicle accidents. Note that tall or elevated equipment will have manufacturer's safe operating wind speeds defined that could be less than 40 mph. The operator's manual should be consulted prior to operation of the equipment.

A tornado is a violent, dangerous, rotating column of air that is in contact with both the surface of the earth and a cumulonimbus cloud or, in rare cases, the base of a cumulus cloud. The Fujita Scale is used to rate the intensity of a tornado by examining the damage caused by the tornado after it has passed over a man-made structure. Based on the Fujita Scale or F-Scale Numbers begin at F0: 40-72 mph and go to F6: 319-379 mph (F6 is generally theoretical). Nearly three-fourths of tornados are on the weak F0-F1 scale with just over two-thirds of deaths resulting from the violent F4-F5 tornados. If tornado wind speeds exceed the 40 mph, stop work and seek shelter immediately if a tornado is seen. If a tornado siren is sounded move immediately to safety indoors and then move to a windowless interior space, basement, stair well, or designated fall-out shelter. Windows should not be opened before an oncoming tornado. If there is no shelter available, seat belt yourself into your stationary vehicle or seek a depression or low spot on the land surface.

1.2.6 Snowfall and Ice Conditions

Working in the winter months will result in activities taking place during periods of snowfall or icy conditions. If you are working during or after snow has fallen, dress appropriately for the conditions. Snow and ice can cause working surfaces to become slippery. Clear snow and ice from work areas to prevent slip hazards. Use caution when performing snow or ice removal activities to prevent injuries. Driving in snowy and icy conditions is also hazardous. Reduce speed and use caution if you must drive in these conditions.

If the weather conditions deteriorate and you do not feel safe working in these conditions, stop work, move to a safe indoor location, and contact your Project Manager to let them know the weather, work conditions, and your location.

1.3 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection. Protection extreme weather conditions can best be accomplished if the conditions are anticipated. Monitor local weather conditions prior to starting work.

1.4 References

Center for Disease Control and Prevention – Natural Disasters and Severe Weather
http://www.bt.cdc.gov/disasters/
National Lightning Safety Institute
NOAA, National Weather Service
Office of Climate, Water, and Weather Services

1.5 Attachment

None

1.6 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer

GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-012 Noise Exposures

1.1 Objective

Working in loud environments can cause hearing damage and loss if the proper protection is not in place. The following procedures describe methods to mitigate unhealthy noise levels and protect hearing.

1.2 General

This SOP is intended for use by employees engaged in work within loud environments. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for work in loud environments and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

Prior to working on a project, an Activity Analysis or Job Hazard Analysis will be performed by the Project Manager or their designee to evaluate the potential hazards and identify steps to be taken to protect workers from hazards. If projects involve high levels of noise from such sources as heavy equipment, power tools, pumps, generators, or other noise source employees should take steps to remove the noise exposure. GEI has an established Hearing Conservation Program located in the GEI Health and Safety Manual.

Hearing protection is required if noise levels in a work area are known to be above 85 decibels (dB), which can be measured with a noise meter. When decibel levels are not known, hearing protection is required if you need to raise your voice to talk to someone standing within a normal speaking distance from you.

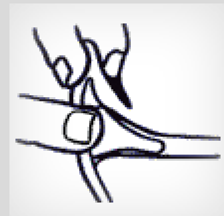
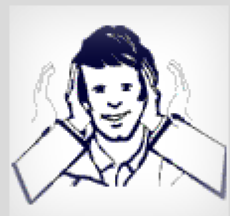
The first option for employee protection from hazardous noise levels is to remove the hazard by taking away the source of the noise or using engineering controls to reduce the level. If this cannot be accomplished, the next control measure to be used is to remove the employee from the source. This can be done by moving the work area to a quieter location or distancing the employee from the noise source. For example, GEI employees do not need to be standing next to an operating drill rig or other heavy equipment, by distancing themselves from heavy equipment or other noise sources the need for hearing protection can be eliminated. The final option for employee protection is personal protective equipment (PPE). Disposable ear plugs are made available to GEI employees and are to be used when required. Additional means of hearing protection will be provided, such as ear muffs, if the disposable ear plugs are not adequate.

Employees should be aware of surroundings such as moving equipment, traffic, and other site hazards when wearing hearing protection.

1.3 Proper Use of Hearing Protection

DISPOSABLE EAR PLUG FITTING INSTRUCTIONS

Before fitting any ear plugs, make sure your hands are clean.
Foam ear plugs are disposable and not intended for reuse.

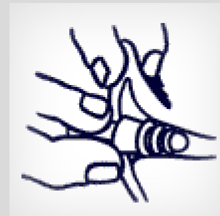
Hold the ear plug between your thumb and forefinger. Roll and compress the entire ear plug to a small, crease-free cylinder. While still rolling, use your other hand to reach over your head and pull up and back on your outer ear. This straightens the ear canal, making way for a snug fit.	
Insert the ear plug and hold for 20 to 30 seconds. This allows the ear plug to expand and fill your ear canal.	
Test the fit. In a noisy environment, and with earplugs inserted, cup both hands over your ears and release. You should not notice a significant difference in the noise level. If the noise seems to lessen when your hands are cupped over your ears, your ear plugs are not fitted properly. Remove and refit following instructions.	
Always remove ear plugs slowly, twisting them to break the seal. If you remove them too quickly, you could damage your ear drum.	

REUSABLE EAR PLUG FITTING INSTRUCTIONS

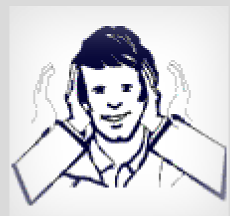
Before fitting any ear plugs, make sure your hands are clean. Reach around your head and pull up and back on your outer ear. This straightens out the ear canal, making way for a snug fit.

Reusable ear plugs should be inspected and cleaned often in soapy water. If they become hard, torn, or deformed they should be replaced.

Hold the stem end of the ear plug and insert it well inside your ear canal until you feel it sealing and the fit is comfortable.



Test the fit. In a noisy environment, and with ear plugs inserted, cup both hands over your ears and release. You should not notice a significant difference in the noise level. If the noise seems to lessen when your hands are cupped over your ears, your ear plugs are not fitted properly. Remove and refit following instructions.



Always remove ear plugs slowly, twisting them to break the seal. If you remove them too quickly, you could damage your ear drum.

1.4 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.5 References

OHSA 29 CFR 1910.95 – Occupational Noise Exposure
OHSA 29 CFR 1926.101 – Hearing Protection
Texas American Safety Company (TASCO)

1.6 Attachment

None

1.7 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURE

SOP HS-014 Utility Mark-out

1.1 Objective

This standard operating procedure (SOP) provides guidance for utility mark-out procedures related to drilling, excavation, or other sub-surface or intrusive activities to avoid injury to GEI employees or property damage. This SOP is applicable when GEI is responsible for its operation or our subcontractor's operation for utility mark-out.

Clients or local agencies may have additional requirements or procedures for the marking of utilities. If local utility mark-out procedures differ from those described within this SOP, applicable state or municipal regulations should be followed.

1.2 General

- This SOP is intended for use by employees engaged in work with sub-surface or intrusive activities. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for subsurface hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.
- The contractor or GEI employee visits the site and marks out each exploration area with white paint, flags, or stakes. Mark-outs will be performed wearing required PPE, including eye protection when using spray paint to perform the mark-out.
- Exploration locations should be marked out with sample identification number(s) and type of sample (e.g., boring, test-pit, or monitoring well).
- The contractor compiles information about the work areas on a request form specified by the state utility mark-out program and provides this information to the mark-out program call center with a phone call or electronic submittal. Work area location maps can be sent to the utility mark-out program to clarify locations.
- The mark-out program customer service representative will provide a mark-out ticket number and a list of utilities notified upon receipt of the request information. This information will be recorded on the GEI documentation form or in other project documents.

- If known, the contractor will also notify non-member utility operators (such as apartment complexes, commercial complexes, railroads with communication cables, etc.).
- Utility companies or their sub-contractors will only mark-out, or clear, utilities under their responsibility. Generally, this means that they will only mark-out utilities within the public right-of-way up to private property boundaries. Information needed to determine the location of utilities on private properties will be requested from the property owner. This may include available property drawings or as-built figures. If this information is not available, additional non-intrusive surveys of the property may be required by a private utility locator to find underground utilities by using techniques, including ground penetrating radar (GPR).
- American Public Works Association (APWA) Uniform Color Code For Marking Underground Utility Lines are:

    1. **White** – Proposed Excavation
    2. **Pink** – Temporary Survey Markings
    3. **Red** – Electric Power Lines, Cables, Conduit and Lighting Cables
    4. **Yellow** – Gas, Oil, Steam, Petroleum, and Gaseous Material
    5. **Orange** – Communications, Alarm, Signal Lines, Cables or Conduit
    6. **Blue** – Water
    7. **Purple** – Radioactive Materials
    8. **Green** – Sanitary and Storm Sewers and Drain Lines

- Before the intrusive work activities begin, the contractor will verify that each utility company has completed a utility location for the work area or the location has been cleared by a private locator and record this on the mark-out request information sheet.
- A visual survey of the project area will be done prior to the start of intrusive activities. This visual inspection will be done to identify signs, manholes, utility boxes, or other evidence of an underground utility is present and has been considered.
- The contractor can begin work on the scheduled work date and time if the utility operators have responded, taking care to find and preserve markings that have been made.
- Completed clearance documentation will be located on the excavation site during excavation activities and kept in project files.
- When excavating near a buried utility, observe the approximate location around that utility.

- If exposing a utility, proper support and protection must be provided so that the utility will not be damaged.
- If the excavation work requires significant spans of the utility to be exposed, it is the contractor's responsibility to support them (to prevent sagging or collapse) as needed. Contact the utility operator for support, guidance, or assistance.
- When the excavation is complete, provide proper backfill for utilities that have been exposed.

- Take care not to damage the conduit or protective coating of a utility. If the contractor damages this, leave the damaged utility exposed and immediately call the utility owner.
- If a gas line is contacted, the contractor must notify police, fire, and emergency personnel, and evacuate employees according to the site evacuation procedures. No attempt should be made to tamper with or correct the damaged utility.
- If the contractor/consultant needs to dig within the approximate location of a combustible, hazardous fluid, or gas line (natural gas, propane or gasoline), soft digging is required (hand digging, vacuum extraction) to a maximum depth of five feet. The approximate location is defined as 24 inches on either side of the designated center line of the utility if the diameter is not provided or 24 inches from each outside edge if the diameter is provided.

1.3 Limitations

- Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.
- Mark-out notification time usually does not include holidays. Make sure holidays are considered and mark-out time is scheduled accordingly. Under no circumstances are intrusive activities allowed to be performed prior to the required mark-out.
- Do not use white paint if precipitation is eminent. Consider using stakes if snow is predicted.

1.4 References

Reference the website for the "Call Before You Dig – 811" for the utility mark-out agency for the state you working in prior to site work. If you have issues locating the appropriate agency, contact the Health and Safety Committee for assistance.

1.5 Attachment

Attachment A – Standard Utility Color Codes
Attachment B – GEI Utility Clearance Documentation Form

1.6 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

COLOR CODE FOR UTILITY MARKING

(BASED ON 'THE AMERICAN PUBLIC WORKS ASSOCIATION' RECOMMENDATIONS AND THE ANSI STANDARD Z-53.1 FOR SAFETY COLORS)

UTILITY	COLOR
PROPOSED EXCAVATION	WHITE
ELECTRIC POWER LINES, CABLES, CONDUIT AND LIGHTING CABLES	RED
POTABLE WATER	BLUE
STEAM, CONDENSATE, GAS OR OIL COMPRESSED AIR	YELLOW
TELECOMMUNICATIONS, ALARM OR SIGNAL LINES, CABLES OR CONDUIT	ORANGE
TEMPORARY SURVEY MARKINGS	PINK
SEWER AND STORM DRAINS	GREEN
CHILLED WATER, RECLAIMED WATER, IRRIGATION AND SLURRY LINES	PURPLE
OTHER	LIGHT BLUE

1.0/4902e011.pdf (12/2004)

Utility Clearance Documentation

Client: ____________________

Project: ____________________

Site: ____________________

Excavation/Drilling Location ID: ____________________

Excavator/Driller: ____________________

GEI PM: ____________________

GEI Field Team Leader: ____________________

Utility Drawings Reviewed: ____________________

Provided By: ____________________

Reviewed By: ____________________

Utility Clearance Call Date: ____________________

Utility Clearance Received back from (list utilities): ____________________

Completed By (Company): ____________________ Date: __________

GEI Staff Responsible for Oversight: ____________________

Metal Detector Survey (yes/no): ____________________

Drilling Location Cleared by: ____________________

Contractor: ____________________ Date: __________

GEI Staff Responsible for Oversight: ____________________

Private Location Clearance Required (yes/no): ____________________

Contractor: ____________________ Date: __________

Methods used for utility location (i.e. GPR, electronic pipe location) ____________________

GEI Staff Responsible for Oversight: ____________________

Hand clearing Performed: ____________________ Date: __________

Contractor: ____________________

GEI Staff Responsible for Oversight: ____________________

Notes: ____________________

____

Based upon the best available information, appropriate utility clearance procedures were performed for the invasive work specified. If client ordered/site specific deviations from existing GEI utility clearance procedures exist, they are approved by the client signature below.

Client Signature (Optional): ____________________________ Date: _____________________

GEI, Inc. Representative: ____________________________ Date: _____________________

STANDARD OPERATING PROCEDURES

SOP No. HS-016 Traffic Hazard Management

1.1 Objective

The objective of this standard operating procedure (SOP) is to prevent or limit the potential for GEI personnel to encounter traffic hazards during field activities.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for traffic hazards. The site-specific health and safety plan (HASP) should include a hazard assessment for the project that identifies the potential for exposure to traffic hazards and the control methods to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

1.3 Traffic Hazard Management

Traffic Hazard Management is the process of identifying and managing the potential risks associated with the movement of traffic through, around, or past a work area. This Traffic Hazard Management SOP is designed to assist employees in identifying and managing these hazards. Work areas should be as safe as possible. It is the responsibility of GEI employees to follow the Traffic Hazard Management plan and adhere to these safety standards. Safety is not negotiable.

Under no circumstances are GEI employees permitted to commence work in a situation that they feel puts their health and safety, or the health and safety of others, at risk.

Major risk factors for work site Traffic Hazard Management include:

- The speed of traffic past or through a work site.
- The clearance between moving traffic, workers, vehicles and equipment, and over-head power lines.
- Traffic volume and vehicle composition.
- Nature and conditions at the work site and approaches to the work site.
- Other factors such as the time of day, sight distance, weather, presence of pedestrians, or cyclists, and the type of work being carried out.

- Other hazards in proximity to the work site (e.g., power lines, open excavations) that may have conflicting measures needing to be considered when developing the plan.

1.4 Site Preparation

The following management measures will be considered whenever working in traffic areas. In addition, remain aware of the amount of traffic around the working area. The work space should be large enough for the job to be completed safely. Check permit, traffic control plans, and flagger/police detail requirements for the local jurisdiction. Perform routine checks of the work zone to make sure there are adequate levels of protection.

1.4.1 Warning Cones and Warning Signs

GEI employees will comply with the Department of Transportation's (DOT) Manual on Uniformed Traffic Control Devices (MUTCD) and/or state regulations for temporary traffic barriers (cones, barriers) and sign placement when required for working in traffic areas. Clearly define the work site by placing traffic barriers around the work space to indicate the space that is needed to safely perform the work. The traffic barrier will help make the work site more visible to other workers and moving vehicles. Place traffic barriers to give yourself adequate space to work, so equipment is not outside the space. OSHA suggests placing the first warning sign at a distance calculated to be 4 to 8 times (in feet) the speed limit (in MPH).

1.4.2 Adequate Light

Requirements for night conditions and work areas with poor visibility are similar to day requirements; however there are a number of additional things to consider, such as visibility of the work site to advancing traffic and sufficient lighting. OSHA requires lighting for workers on foot and equipment operators to be at least 5 foot-candles or greater.

Visibility of the work area can be increased by employing the following measures:

- Using parked vehicles hazard and flashing lights.
- Wearing reflective safety vest that is in good condition.
- Providing adequate lighting to illuminate the work area. This lighting should be positioned so that there is no glare to approaching drivers.
- Placing advance warning signs and cones with retro reflective stripes so that they are visible to road users.

1.4.3 Distance from the Nearest Traffic Lane

Work areas located along roadsides will have a minimum clearance as defined by DOT's MUTCD and/or state or local DOT regulations for cone and sign placement.

1.4.4 PPE

The proper personal protective equipment (PPE), as outlined in the project HASP, will be worn when appropriate. The color/type of safety vest will comply with site regulations.

1.5 Equipment Operation

Vehicles and heavy equipment operators should use a spotter when possible if it is necessary to drive in reverse to reduce risk of collision with oncoming traffic. If it is necessary to drive against the flow of traffic make sure this area is within the work zone and properly blocked off from oncoming traffic.

1.6 Pedestrian Safety

When working near pedestrian traffic, a safe walkway will be established. Refer to local regulations when establishing pedestrian walkways.

1.7 Limitations

Follow safety procedures as defined in the site-specific HASP, federal DOT, and local jurisdictions. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.8 References

DOT's Manual on Uniformed Traffic Control Devices (2009 Edition)
https://www.osha.gov/SLTC/etools/hurricane/work-zone.html

1.9 Attachments

None

1.10 Contact

GEI Corporate Health and Safety Officer
GEI East-North Regional Health and Safety Officer
GEI East-South Regional Health and Safety Officer
GEI Mid-West Regional Health and Safety Officer

GEI Western Regional Health and Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-018 Working Around Heavy Equipment

1.1 Objective

The objective of this standard operating procedure (SOP) is to prevent or limit the physical hazards when working around heavy equipment for GEI personnel.

1.2 General

This SOP is intended for use by employees engaged in work with the potential for working near heavy equipment. The site-specific health and safety plan (HASP) should include a hazard assessment for the project for working near heavy equipment to be implemented by GEI employees. These hazards should be reviewed in the project safety briefing and documented on the Project Safety Briefing form, found on the Health and Safety page of the GEI intranet.

1.3 Heavy Equipment

Heavy equipment (excavators, backhoes, drill rigs, etc.), can present many physical hazards that can result in serious injury or death if the proper safety precautions are not followed. The following is a list of precautions to be aware of when working around heavy equipment:

- Wear appropriate personal protective equipment (PPE), including a reflective, high-visibility safety vest.
- Always keep your distance from moving vehicles.
- Do not assume the vehicle operator knows where you are or where you are going. Make sure to make eye contact and receive acknowledgement of your presence with the operator. Avoid working near heavy equipment, but if unavoidable, communicate your location with the heavy equipment operators. If using hand signals, discuss the signals with the equipment operator prior to starting work.
- Watch for moving equipment. Construction sites can have a lot of activity and vehicles may be moving closer than you may think.
- Do not rely on back-up or other alarms. They may not be working or you may not hear them with the noise of other activities taking place in the area.
- Stay out of the swing radius of cranes, excavators, or other equipment that swings or rotates.
- Do not walk beside a moving vehicle, the vehicle may turn, slip, or the load may shift causing the vehicle to go off course.

- Do not ride on the outside of a moving vehicle.
- Always stay out from under a suspended load on cranes or hoists, even if it means taking the long way around.
- Do not walk behind a piece of equipment that is backing up. The operator may not see you.
- If working next to heavy equipment is unavoidable, be aware of the hazards including pinch points and moving parts. Use a spotter to watch the work area for moving equipment.
- If necessary, ask the operator to stop equipment operation to perform your work tasks.
- Verify the location and operation of emergency shut-off devices on the equipment.
- Be aware of the fuels and chemicals associated with the equipment. Have a spill prevention and response plan in place that includes the appropriate containment materials (i.e., spill kit).
- Do not wear loose fitting clothing when working around moving equipment (i.e., drill rig augers).
- Do not operate heavy equipment.
- Do not use cellular telephones near operating equipment.

1.4 Limitations

Follow safety procedures as defined in the site-specific HASP. Appropriate PPE must be worn correctly to provide the intended level of protection.

1.5 References

OSHA 29 CFR 1926.600 – Subpart O; Motor Vehicles, Mechanized Equipment, and Marine Operations.
www.*toolboxtopics.com*/Construction
Caterpillar Safety – http://safety.cat.com/

1.6 Attachment

None

1.7 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

STANDARD OPERATING PROCEDURES

SOP No. HS-025 Manual Lifting

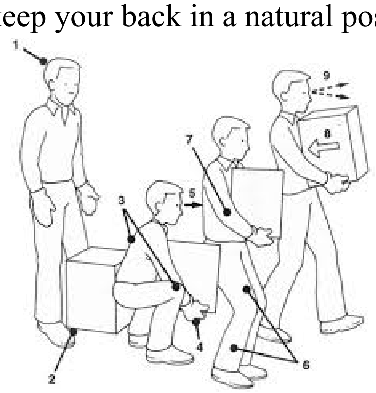
1.1 Objective

The purpose of the GEI Consultants, Inc. (GEI) Manual Lifting SOP is to identify and reduce potential work-related musculoskeletal disorder (WMSD) hazards. The SOP is intended to comply with state regulations and safe work practices developed by the Occupational Safety and Health Administration (OSHA). Modifications to meet these requirements will be made to this program as changing laws or regulations dictate.

1.2 General

The following Safe Lifting guidelines will be followed by GEI employees involved in manual lifting activities:

- Before manual lifting is performed, a hazard assessment must be completed. The assessment must consider size, bulk, and weight of the object(s), if mechanical lifting equipment is required, if two-man lift is required, whether vision is obscured while carrying and the walking surface and path where the object is to be carried.
- Get a co-worker to help if equipment or other item is too heavy to lift.
- If possible, use powered equipment instead of manually lifting heavy materials. Lifting equipment such as dollies, hand trucks, lift-assist devices, jacks, or carts can be provided for employees.
- Reduce lifts from shoulder height and from floor height by repositioning the shelf or bin.
- Make sure walkways are clear of tripping hazards before moving materials.
- Use your legs and keep your back in a natural position while lifting. Keep the load close to your torso.



- Test the load to be lifted to estimate its weight, size, and bulk and to determine the proper lifting method.

- Do not twist while carrying a load. Instead, shift your feet and take small steps in the direction you want to turn.
- Make sure there are appropriately marked and sufficiently safe clearances for aisles and at loading docks or passageways where mechanical-handling equipment is used.
- Properly stack loose or unboxed materials which might fall from a pile by blocking, interlocking, or limiting the height of the pile to prevent falling hazards.
- Bags, containers, bundles, etc. should be stored in tiers that are stacked, blocked, interlocked, and limited in height so that they are stable and secure to prevent sliding or collapse.
- Storage areas should be kept free from accumulation of materials that could lead to tripping, fire, or explosion.
- Work methods and stations should be designed to minimize the distance between the person and the object being handled.

Supervision must periodically evaluate work areas and employees' work techniques to assess the potential for and prevention of injuries. New operations should be evaluated to engineer out hazards before work processes are implemented.

1.3 Injury Reporting

Injuries experienced during manual lifting activities should receive prompt medical attention. If a GEI employee suffers an injury on the job, he/she is to report the injury to their immediate supervisor within 2 hours of the incident. The supervisor will immediately notify the CSHO and Director of Human Resources.

After verbal notification has been made, an Incident and Accident Report Form is to be completed by the employee and/or Project Manager and submitted to Human Resources and the CHSO within 24 hours of its occurrence. This form is available on the Health and Safety site on the GEI Intranet.

Upon notification from a Branch or Office Manager, Human Resources, and/or the receipt of the Incident and Accident Report Form, the CHSO and/or the RHSO will conduct an investigation and evaluation of the incident and the incident response. Information received will be analyzed for the hazards and risk factors associated with the incident. The CHSO will then recommend (as necessary) engineering controls, PPE, training or other appropriate measures to minimize the potential for future musculoskeletal injuries. The CHSO/RHSO will develop educational information based on lessons learned for distribution to GEI employees.

1.4 Training

Training will include general principles of ergonomics, correct maul lifting training to avoid musculoskeletal injuries, recognition of hazards and injuries, procedures for reporting hazardous conditions, and methods and procedures for early reporting of injuries.

1.5 Ergonomic Evaluation Process

1.5.1 Requesting an Evaluation

An evaluation can be requested by the employee if they have concerns about their workstation, tasks, or are experiencing discomfort while working. The employee can request an evaluation by directly contacting their supervisor, Branch Manager, RHSO, HR or the CHSO via email. The Branch Manager will be notified of the requested evaluation. The Coordinator will send the Worksheet to the employee, who will complete it and return it to the Coordinator. The Coordinator will review the Worksheet and suggest modifications to the employee. If these modifications do not resolve the issue, the Coordinator will then schedule an in-person evaluation with the employee. If an employee is experiencing discomfort at their workstation and a request for an evaluation has been made, the evaluation will occur as soon as possible to assist the employee. If the Coordinator is not available another Coordinator will be assigned the evaluation.

Coordinators will be trained to treat the information obtained during the evaluation as confidential. If there are concerns the employee does not wish to discuss with the Coordinator due to their personal nature, a representative from HR will be designated to assist with the evaluation.

1.5.2 Job Hazard Analysis

Once the evaluation has been scheduled, the Coordinator will meet with the employee at their workstation and conduct the interview and review their work area. The Ergonomic Evaluation Checklist will help guide the Coordinator through a series of questions to help evaluate the potential ergonomic safety concerns. The evaluation is designed to be a conversation between the employee and Coordinator to help develop an open dialog. During the evaluation the Coordinator will identify ergonomic risk factors and implement immediate corrective actions, if possible. In many cases, simple adjustments can be made to the work station using existing equipment. Ergonomic work practices including "ergo breaks" and stretching can also be recommended.

1.5.3 Corrective Actions

During the evaluation the Coordinator may suggest adjustments that can be made to the existing work station. The employee will be encouraged to adopt the suggestions but ultimately has the choice to accept and implement them. Once the evaluation has been completed, the Coordinator will review the evaluation and if there are concerns, they will evaluate them with the HSC. Once the HSC has discussed the evaluation and developed corrective actions, they will be documented on the Checklist. The corrective actions will be shared with the employee and the Branch Manager. Prior to equipment purchases, approval will be authorized by the local branch manager.

Broken equipment will be taken out of service, properly disposed of and replaced. If improper equipment is being used, the proper equipment will be obtained or purchased with approval. If the employee's workspace presents a hazardous condition (fire hazards, trip hazards, noise exposure, etc.) the hazard will be corrected, if possible, or the employee will be moved to a safe workspace. If the equipment being used is not an appropriate fit for the employee, a suggestion will be made in the evaluation report to obtain or purchase the equipment that fits the employee properly.

If a repetitive task is identified, options will be discussed with the Branch Manager, the HSC and/or other appropriate personnel to evaluate whether the task can be altered to facilitate a safer condition. Many times accelerated deadlines, apprehension, or lack of options cause an employee to believe they don't have a choice and will just push through to complete the task potentially causing an ergonomic injury. These types of situations need to be recognized and corrected. A proactive approach by both the Branch Manager and employee should be instituted to prevent or anticipate these situations so that the correct equipment, additional employees or better planning can be incorporated while still meeting the deadline.

The organization of the workspace is also an important ergonomic factor. Items should be placed so that frequently used equipment is within arm's reach and located on the correct side of the body for which that equipment is used to prevent unnecessary twisting or reaching. Having adequate space to complete tasks is necessary but may not be achieved if piles and unnecessary items occupy the space. The Coordinator can suggest how to take advantage of tools and organizational skills to free up space.

Other areas of concern may be outside factors that occur away from the office. If the employee conducts field work, the tasks should be completed with ergonomics in mind.

A separate evaluation of these tasks may be conducted to determine if a different process or equipment may be used to reduce any unnecessary pressure or fatigue to the employee's body. At times when employees have permission to work from home or use their GEI computers at home, in hotels while traveling, in an environment that is not ergonomically correct, employees will be encouraged to adopt the ergonomic recommendations they learn at work.

Employee's hobbies can also pose ergonomic risks. Hobbies that involve repetitive motions, prolonged postures, vibration, excessive force/overexertion and adverse environmental factors may cause ergonomic injuries that can be aggravated at work.

During the interview process, the Coordinator will try to identify these risks and discuss techniques to help alleviate discomfort and minimize additional injury. It will be up to the employee to modify anon-related work risks.

If an employee is experiencing discomfort, efforts will be made to alleviate the discomfort while at work. For example, if an employee has a physical injury that occurred outside of work that requires them to keep their leg elevated, the employee can work with their Coordinator to determine a solution. This may involve temporarily modifying their workstation or transferring to another workstation. Healthy work practices and generally good health are keys to staying comfortable at work too. Regular stretch breaks, good posture, vision check-ups, good sleep habits and maintaining a healthy weight are factors in creating a comfortable work environment. If a physical non-work related problem persists and impedes the employee from being effective at work, suggestions may be made to see a personal physician for further advice.

1.5.4 Reporting and Follow-up

Once the evaluation has been completed and the Coordinator's suggestions have been implemented, the Coordinator will document the findings on the Checklist and an evaluation report will be completed and submitted to the employee, the evaluated employee's Branch Manager, and the CHSO. Then a follow-up will be conducted by the Coordinator to evaluate whether the adjustments were successful. The timeline for follow-up will be based on the adjustments suggested and employed. If new equipment is installed, the Coordinator will follow-up after the equipment has been installed and the employee has had time to adjust to it. If an injury has been identified, the Coordinator will notify the Branch Manager and CHSO immediately following the evaluation. This will confirm on-going management of the injury.

During the follow-up evaluation the Coordinator will make visits to the employee's workstation and assess visually and through interviews determine how the changes have been received. Each of these follow-ups will be documented on the Checklist. If during the follow-up a re-adjustment or different equipment is needed, the reevaluation process will continue until the employee is comfortable.

1.6 Limitations

Follow safety procedures for manual lifting.

1.7 References

OSHA Technical Manual (OTM), Section VII: Chapter 1 - Back Disorders And Injuries

1.8 Attachments

None

1.9 Contact

GEI Corporate Health & Safety Officer
GEI East – North Regional Health & Safety Officer
GEI East – South Regional Health & Safety Officer
GEI Central Regional Health & Safety Officer
GEI West Regional Region Health & Safety Officer

Appendix F

Emergency Event Procedures for GEI Personnel

Emergency Event Procedures for

GEI Personnel

(Skillman Street Former

Holder Station Site)

Emergency Plan Procedures

The following emergency plan was developed to address what actions will be taken in the event of an emergency including natural disasters, infrastructure failure (e.g. gas leaks, transformer explosion, etc.), or potential or actual terrorist event in New York City. Although infrequent and random, it is important to have a plan of action and response in the event of one of these events. This plan is a supplement to the project specific health and safety plan (HASP) that is prepared and utilized at New York City job sites.

If an emergency event has occurred, GEI personnel will take the following actions. The actions are broken down into a two tiered approach for an event at or near a job site and an event in NYC not immediately near or affecting the job site:

For an Emergency Event at or in close proximity to the Job Site:

- In spite of the pending emergency try to stay calm. While it is easy for panic to set in, you will be safer if you can try to control your emotions and get yourself to safety.
- If present, follow the instructions of emergency personnel.
- Follow the site Health and Safety plan procedures.
- If you are in the immediate vicinity of the emergency or terrorist event, move away from the scene. Be cautious that you avoid becoming part of a crowd. Sometimes panic can set a crowd into frenzy and more injuries may result.
- Do not put yourself in danger. Do not enter or go near a building that has been damaged by an explosion, fire or smoke.
- If you feel you can help someone else without endangering yourself, this is fine. However, it's a bad idea to risk hurting yourself to help others.
- If the jobsite is evacuated go the designated gathering point [See attached Evacuation Plan].
- Evacuation of an area impacted by a terrorist event will likely be on foot, if you are far enough away from the event immediately get into your vehicle and follow the evacuation routes and actions established in the next section.
- If you cannot get to your vehicle locate the closest public transportation such as the subway. See the next section for the nearest subway location.
- If a visible vapor/gas or dust cloud is present stay upwind of the material if possible. Check wind direction by looking at the tops of trees or by movement of plants or shrubs.
- If you cannot move away from the vapor/gas or dust cloud quickly enough, you may consider using your GEI full-face respirator to protect your respiratory system & putting on a Tyvek® suit for skin protection if indicators of a biological, chemical, or radiological agent are present. Evacuate the area as quickly as possible.

- Once evacuation to a safe place has occurred follow the procedures for communications and getting information.
  - Stay tuned to local new stations (television and radio) to evaluate the extent of the emergency. If you are in your vehicle tune into AM 880 or AM 1010 on the radio for news updates and traffic updates. Follow the advice of local emergency officials.
  - Stay tuned to local media for information about road and bridge closures. New York City's 311 or 212-504-4115 can help you monitor evacuation routes. (For the metropolitan New York City area, 511 NY also will provide information about northern New Jersey and southwestern Connecticut.) Information can also be accessed through the internet at NYC DOT (http://nyctmc.org/).
  - Notify your immediate supervisor and project of the emergency and where you are going (see attached Communication Procedures). Once you have evacuated the area notify your immediate supervisor, project manager, office, and family members of your condition and location.
- Make a determination if evacuation from the City is feasible and appropriate.

For An Event in the Greater NYC not impacting the Site and does not have the potential to impact site operations

- Stay tuned to local new stations (television and radio) to evaluate the extent of the emergency. If you are in your vehicle tune into AM 880 or AM 1010 on the radio for news updates and traffic updates. Follow the advice of local emergency officials.
- Stay tuned to local media for information about road and bridge closures. New York City's 311 or 212-504-4115 can help you monitor evacuation routes. (For the metropolitan New York City area, 511 NY also will provide information about northern New Jersey and southwestern Connecticut.) Information can also be accessed through the internet at NYC DOT (http://nyctmc.org/).
- Notify your immediate supervisor and project of the emergency and where you are going (see attached Communication Procedures). Once you have evacuated the area notify your immediate supervisor, project manager, office, and family members of your condition and location.
- Make a determination if evacuation from the City is feasible and appropriate.

Evacuation Procedures and Routes

The following are potential evacuation routes from the Site including main roads for vehicle traffic and use of the public transportation system (i.e. subway/ trains). Keep in mind that these routes may not be accessible and you may have to walk out of the area nearest the emergency. It is a good idea to know where you will go and how you will get there and alternate routes. If the Site is evacuated notify the GEI Project Manager who in turn will notify the Grid Project Manager of this action.

Gathering Point

If GEI employees need to evacuate the Site the primary off-site meeting place is Classon Triangle (intersection of Classon Ave and Kent Ave with Wallabout Street). Once all GEI employees are accounted for, decisions of possible of evacuation from the City will be decided by the GEI Project Manager and Site Safety Officer (SSO). If the primary gathering point is compromised by the emergency evacuate to the secondary gathering point is the Middleton Playground (intersection of Middleton Street and Wallabout Street).

If Roadways and Bridges are intact:

Vehicle Evacuation Routes

Three main bridges lead out of the Brooklyn: Whitestone (I-678), Triborough Bridge (a.k.a. Robert F. Kennedy Bridge) (I-278), or the Throgs Neck Bridge (I-295), respectively. If the bridges have been the focus of event, then do not take the bridges. The preferred route from the site is traveling to the I-278 East/Brooklyn Queens Expressway to I-495 East to I-678 North (over the Whitestone Bridge) and follow CT 15 (Hutchinson River Parkway North) or I-95 North to I-91 North to Route 3. The main route map is attached with the alternate routes over the Triborough Bridge and the Throgs Neck Bridge.

An alternate route could include using the Port Jefferson ferry to Bridgeport, CT. The route map is attached with the driving directions to the ferry station.

Evacuation through Manhattan is unlikely in a terrorist event, but if the event is not in Manhattan the evacuation routes can include going through the Brooklyn Battery Tunnel on I-278 or across the Brooklyn Bridge.

If Roadways and Bridges are not intact:

Subway/ Trains

If city evacuation is ordered or the GEI SSO orders an evacuation of the job site, the attached NYC subway map has been included for reference. The subway/ train is only a viable alternative if the subway system is operational and has not been the target of an attack. If the subway/ public transit has been the focus of an attack then the subway system will be avoided.

The closest subway station to the Skillman Street Former Holder Station Site is the Flushing Avenue Station located at the intersection of Flushing Avenue and Marcy Avenue. The route from the site to the Flushing Avenue Station is 0.5 miles. You would go north on Skillman Street to the first right which is Flushing Avenue. Go 0.4 miles and take a left onto Marcy Avenue. The G subway line runs out of this station to Queens. The 2nd Flushing Avenue station is 0.9 miles from the site, a few blocks further, which carries the J and M lines into Manhattan.

Buses may be a possible transportation option if you can't get to the subway station.


Metropolitan Transportation Authority
MTA New York City Subway
THE BRONX
MANHATTAN
QUEENS
BROOKLYN
Long Island Sound
Hudson River
East River
Jamaica Bay
LAGUARDIA AIRPORT
JFK INTERNATIONAL AIRPORT
CENTRAL PARK
PROSPECT PARK
Key
Part-time line extension
Local service only
All trains stop (local and express service)
Free subway transfer
Free out-of-system subway transfer (excluding single ride ticket)
Normal service
Additional express service
Station Name
Terminal
Accessible station
© 2010 Metropolitan Transportation Authority
Design: Michael Hertz Associates, NYC
03/10

Communication Plan

Communication services may be interrupted or you may not have access to others. Consider a few different communication alternatives:

- An email or text message back to the office may be easier than a telephone call.
- Also a long distance phone may be easier to make than a local call.
- Call or email (or text if your phone has this option) from a safe location.
- If the GEI cell phone does not work find a land-line as cellular telephone service may be overwhelmed or not in service.

Panicked family, co-workers, and friends may become more panicked if they can't contact you (or, vice versa should some incident happen where your family lives). It's also a good idea to keep in close touch with your co-workers and supervisor. At a minimum your supervisor and project manager should be contacted by you at the end of each work day if you are out in the field. Let people know where you're going and when you'll be back. This way, if someone does need to find you, they will know where to start looking.

In the event of an emergency GEI personnel will contact via telephone, email, or texting Melissa Felter as the Project Manager. The Project Manager will notify the Branch Manager. The Branch Manager will notify the Corporate Health and Safety Manager who in turn will inform the COO of the emergency and the actions taken by GEI personnel. The Project Manager or the Task Manager will be responsible for notifying the National Grid Project Manager of the situation.

Communication Flowchart – Skillman Street

Former Holder Station

GEI Field Personnel

1. TBD
2. TBD
3. TBD
4. TBD
5. TBD
6. TBD

Project Manager/Engineer

1. Melissa Felter (860) 368-5328 or (860) 608-9717
2. Matt O'Neil (401) 533-5152 or (860) 608-9725

National Grid

1. Don Campbell (718) 963-5453 or 347-452-5973
2. TBD

Branch Manager

Fred Johnson (860) 368-5356 or (860) 608-9821

Corporate Health and Safety Officer

Robin DeHate (813) 774-6564 or (813) 323-6220

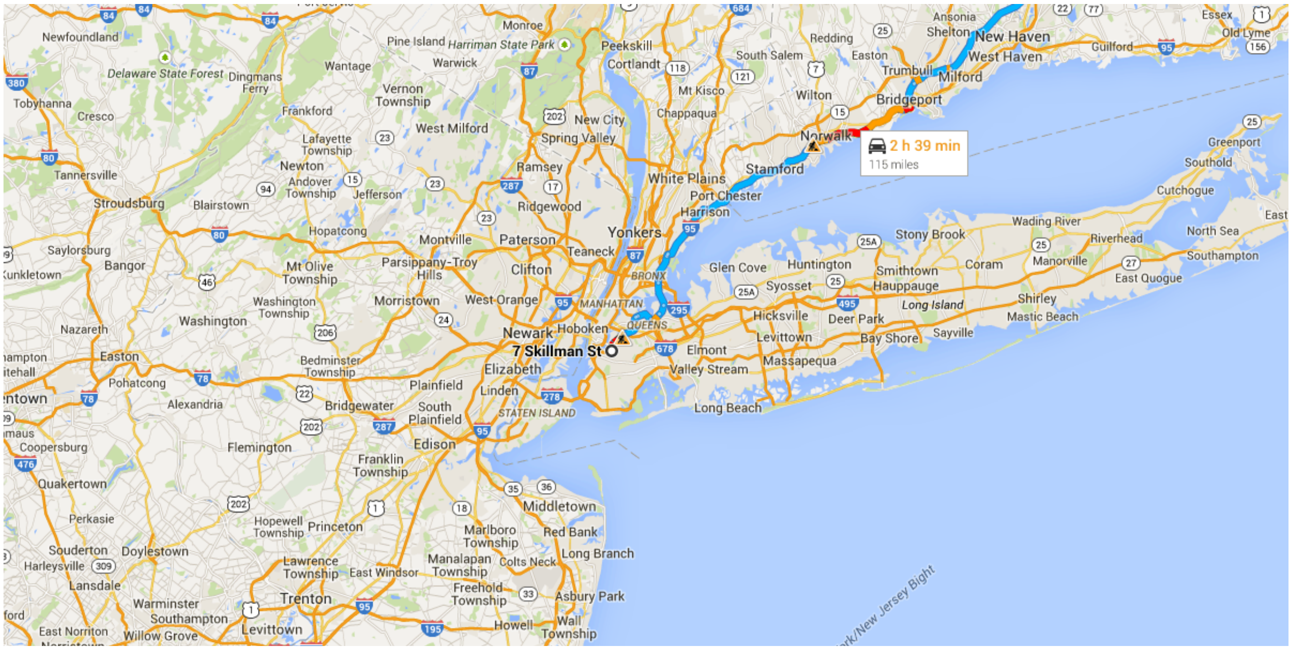
COO

Ray Hart (916) 631-4563 or (916) 752-1911

Evacuation Routes

Google

Directions from **7 Skillman St** to **GEI Consultants Inc**



7 Skillman St

Brooklyn, NY 11205

Get on **I-278 E** from **Flushing Ave**, **Kent Ave** and **Williamsburg St E**

0.5 mi / 2 min

1. Head **north** on **Skillman St** toward **Flushing Ave**

   121 ft

2. Turn **left** onto **Flushing Ave**

   0.1 mi

3. Turn **right** at the 2nd cross street onto **Kent Ave**

   0.1 mi

4. Turn **right** onto **Penn St**

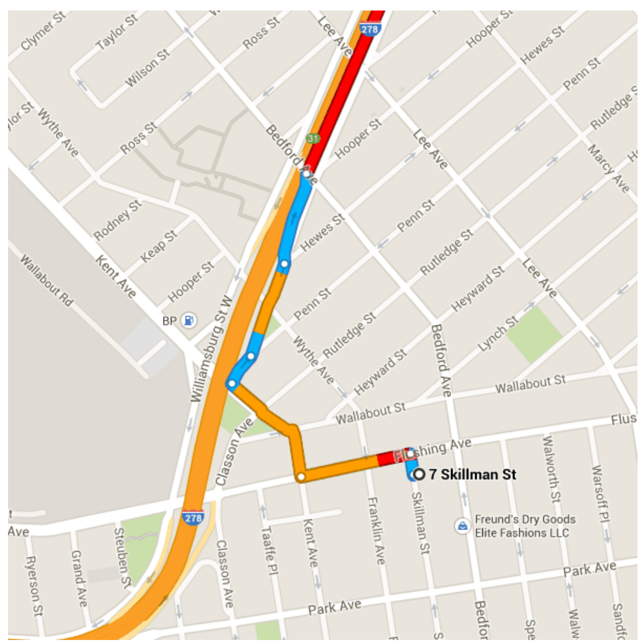
   194 ft

5. Slight **left** onto **Williamsburg St E**

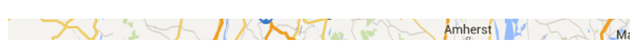
   0.1 mi

6. Take the **Interstate 278 E/Bklyn - Qns Expwy E** ramp on the **left** to **Triboro Br/La Guardia Airport**

   0.1 mi



Map data ©2015 Google



Continue on **I-278 E**. Take **I-678 N**, **I-95 N**, **CT-8 N**, **CT-15 N** and **I-91 N** to **CT-94 E/Hebron Ave** in Glastonbury. Take exit **8** from **CT-2 E**

114 mi / 2 h

7. Merge onto **I-278 E**

2.8 mi

8. Keep **left** to stay on **I-278 E**

2.6 mi

9. Keep **right** at the fork to continue on **Brooklyn Queens Expy E**

0.8 mi

10. Take the **Grand Central Pkwy E** exit on the **left** toward **Terminal B/Terminal C/Terminal D**

0.2 mi

11. Merge onto **Grand Central Pkwy**

2.2 mi

12. Take exit **9E** for **Whitestone Expwy/New York 25A/Northern Blvd** toward **Interstate 678**

0.6 mi

13. Keep **left**, follow signs for **I-678/Whitestone Bridge/Van Wyck Expy/Kennedy Airport**

0.2 mi

14. Continue onto **Whitestone Expressway**

0.9 mi

15. Merge onto **I-678 N**

1.3 mi

16. Keep **right** at the fork to stay on **I-678 N**, follow signs for **Whitestone Bridge/Bronx**

⚠ Partial toll road

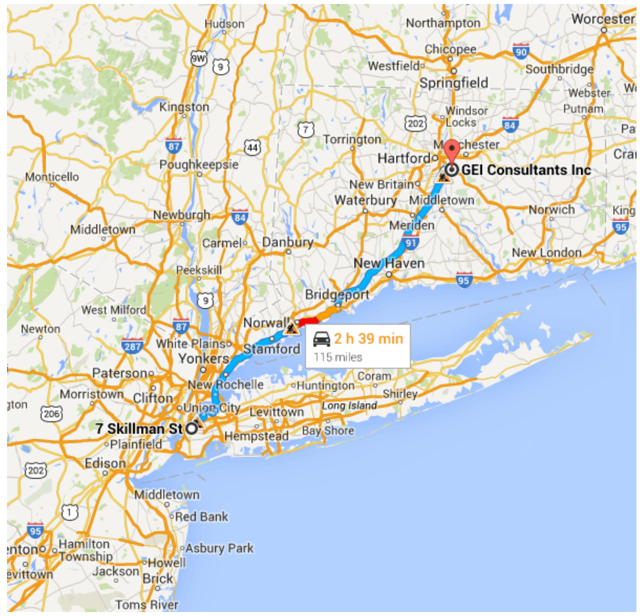
3.2 mi

17. Continue onto **Hutchinson River Pkwy N**

4.0 mi

18. Take exit **6** for **Interstate 95 N** toward **New Haven**

0.3 mi



19. Merge onto **I-95 N**
    Partial toll road
    Entering Connecticut

    40.9 mi

20. Take exit **27A** for **Connecticut 25/Connecticut 8** toward **Trumbull/Waterbury**

    0.4 mi

21. Continue onto **CT-25 N/CT-8 N**

    3.3 mi

22. Keep **right** at the fork to continue on **CT-8 N**, follow signs for **Connecticut 8 N/Connecticut 15 N/Shelton/Waterbury**

    1.8 mi

23. Take exit **9** to merge onto **CT-15 N/Merritt Pkwy** toward **CT-15**

    3.7 mi

24. Keep **left** to continue on **CT-15 N**

    27.0 mi

25. Take exit **68 N-E** to merge onto **I-91 N** toward **CT-66 E/Hartford/Middletown**

    14.0 mi

26. Take exit **25-26** to merge onto **CT-3 N** toward **Glastonbury**

    2.3 mi

27. Take the exit onto **CT-2 E** toward **Norwich**

    1.0 mi

28. Take exit **8** for **Connecticut 94**

    0.2 mi

Continue on **CT-94 E/Hebron Ave**. Drive to **Winding Brook Dr**

0.8 mi / 3 min

29. Turn **left** onto **CT-94 E/Hebron Ave**

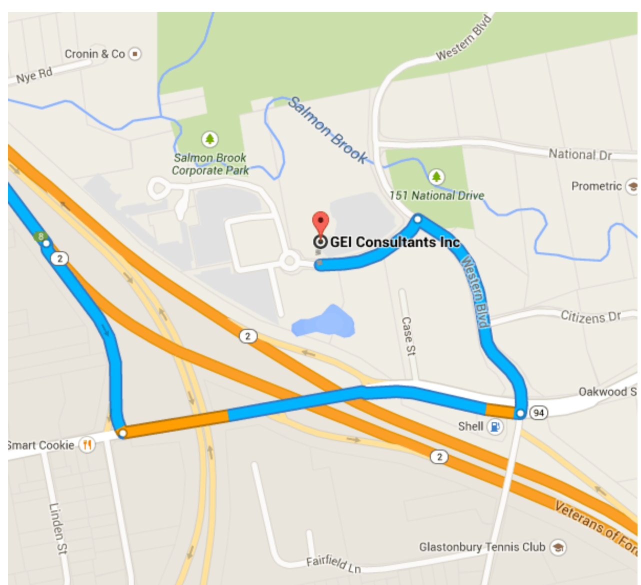
    0.4 mi

30. Turn **left** onto **Western Blvd**

    0.2 mi

31. Turn **left** onto **Winding Brook Dr**
    Destination will be on the right

    0.1 mi



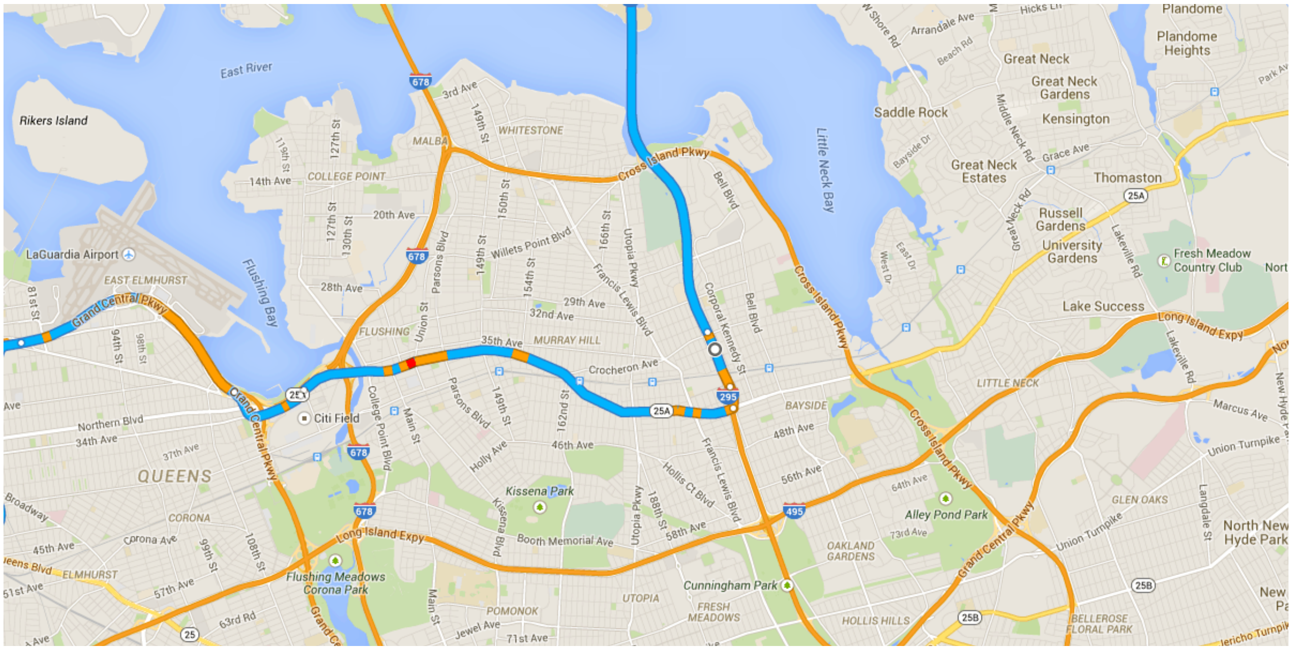
GEI Consultants Inc

455 Winding Brook Drive, Glastonbury, CT 06033

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Google

Directions from **7 Skillman St** to **GEI Consultants Inc**



○ **7 Skillman St**
Brooklyn, NY 11205

Get on **I-278 E** from **Flushing Ave**, **Kent Ave** and **Williamsburg St E**

0.5 mi / 2 min

1. Head **north** on **Skillman St** toward **Flushing Ave**

   121 ft

2. Turn **left** onto **Flushing Ave**

   0.1 mi

3. Turn **right** at the 2nd cross street onto **Kent Ave**

   0.1 mi

4. Turn **right** onto **Penn St**

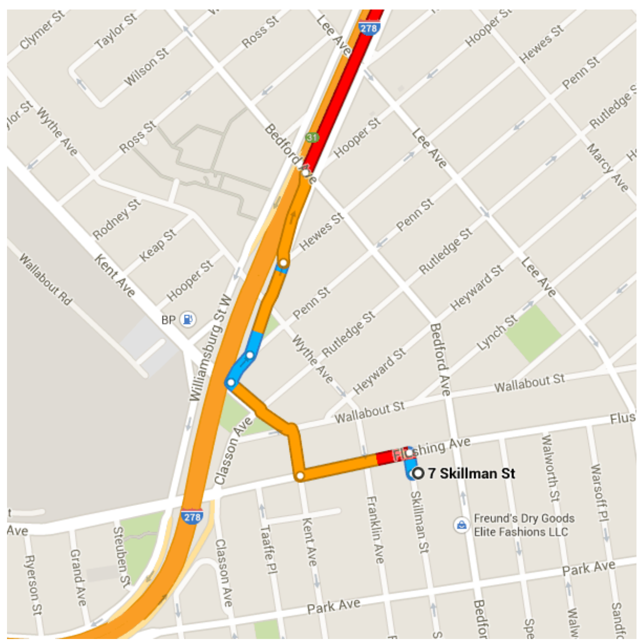
   194 ft

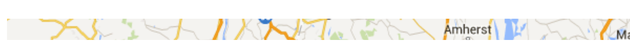
5. Slight **left** onto **Williamsburg St E**

   0.1 mi

6. Take the **Interstate 278 E/Bklyn - Qns Expwy E** ramp on the **left** to **Triboro Br/La Guardia Airport**

   0.1 mi

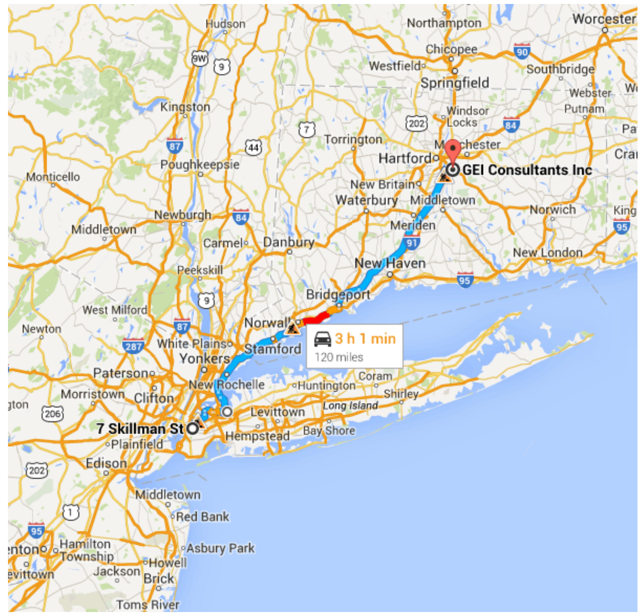




Map data ©2015 Google

Continue on **I-278 E**. Take **I-95 N**, **CT-8 N**, **CT-15 N** and **I-91 N** to **CT-94 E/Hebron Ave** in Glastonbury. Take exit **8** from **CT-2 E**

119 mi / 2 h 12 min



7. Merge onto **I-278 E**

2.8 mi

8. Keep **left** to stay on **I-278 E**

2.6 mi

9. Keep **right** at the fork to continue on **Brooklyn Queens Expy E**

0.8 mi

10. Take the **Grand Central Pkwy E** exit on the **left** toward **Terminal B/Terminal C/Terminal D**

0.2 mi

11. Merge onto **Grand Central Pkwy**

2.2 mi

12. Take exit **9E** for **Northern Blvd** toward **New York 25A E**

0.7 mi

13. Keep **left** to continue toward **NY-25A E/Northern Blvd**

266 ft

14. Continue straight onto **NY-25A E/Northern Blvd**

3.8 mi

15. Turn **left** onto **Clearview Expressway Service Road**

0.2 mi

16. Slight **left** to stay on **Clearview Expressway Service Road** (signs for **Service Rd/35 Ave**)

0.5 mi

17. Merge onto **I-295 N** via the ramp on the **left** to **Throgs Neck Dr**

⚠ Partial toll road

4.4 mi

18. Keep **right** at the fork to continue on **I-695 N**, follow signs for **I-95 N/New Haven**

1.7 mi

19. Merge onto **I-95 N**
   Partial toll road
   Entering Connecticut

   44.8 mi

20. Take exit **27A** for **Connecticut 25/Connecticut 8** toward **Trumbull/Waterbury**

   0.4 mi

21. Continue onto **CT-25 N/CT-8 N**

   3.3 mi

22. Keep **right** at the fork to continue on **CT-8 N**, follow signs for **Connecticut 8 N/Connecticut 15 N/Shelton/Waterbury**

   1.8 mi

23. Take exit **9** to merge onto **CT-15 N/Merritt Pkwy** toward **CT-15**

   3.7 mi

24. Keep **left** to continue on **CT-15 N**

   27.0 mi

25. Take exit **68 N-E** to merge onto **I-91 N** toward **CT-66 E/Hartford/Middletown**

   14.0 mi

26. Take exit **25-26** to merge onto **CT-3 N** toward **Glastonbury**

   2.3 mi

27. Take the exit onto **CT-2 E** toward **Norwich**

   1.0 mi

28. Take exit **8** for **Connecticut 94**

   0.2 mi

Continue on **CT-94 E/Hebron Ave**. Drive to **Winding Brook Dr**

0.8 mi / 3 min

29. Turn **left** onto **CT-94 E/Hebron Ave**

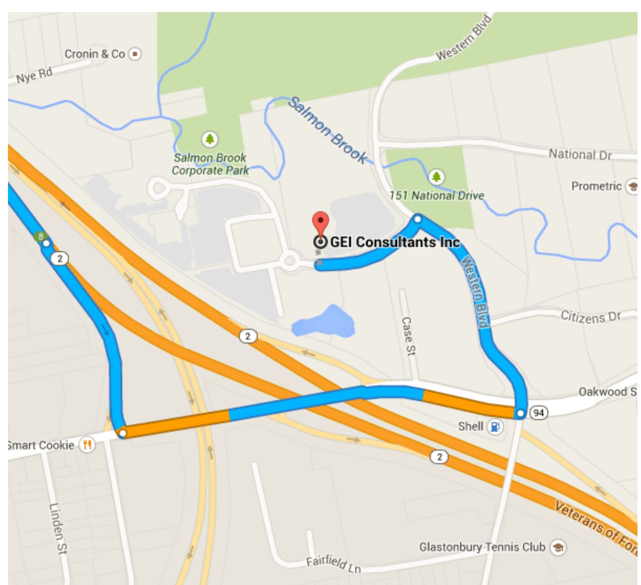
   0.4 mi

30. Turn **left** onto **Western Blvd**

   0.2 mi

31. Turn **left** onto **Winding Brook Dr**
   Destination will be on the right

   0.1 mi



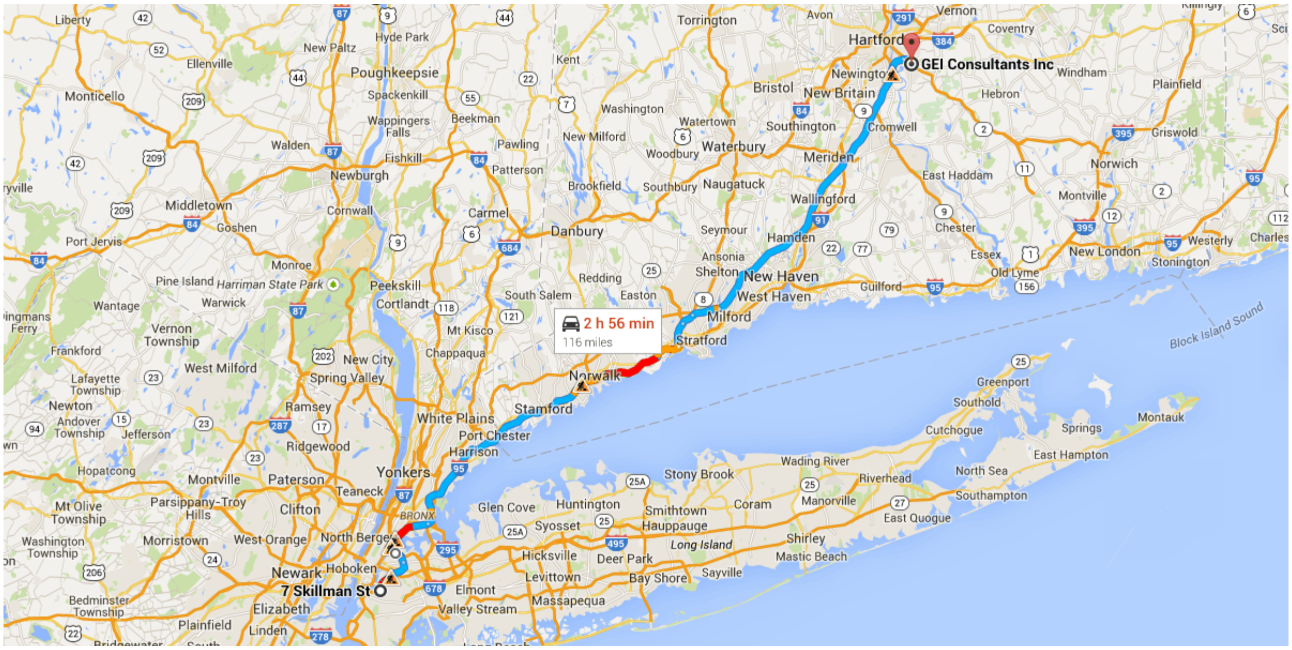
GEI Consultants Inc

455 Winding Brook Drive, Glastonbury, CT 06033

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Google

Directions from **7 Skillman St** to **GEI Consultants Inc**

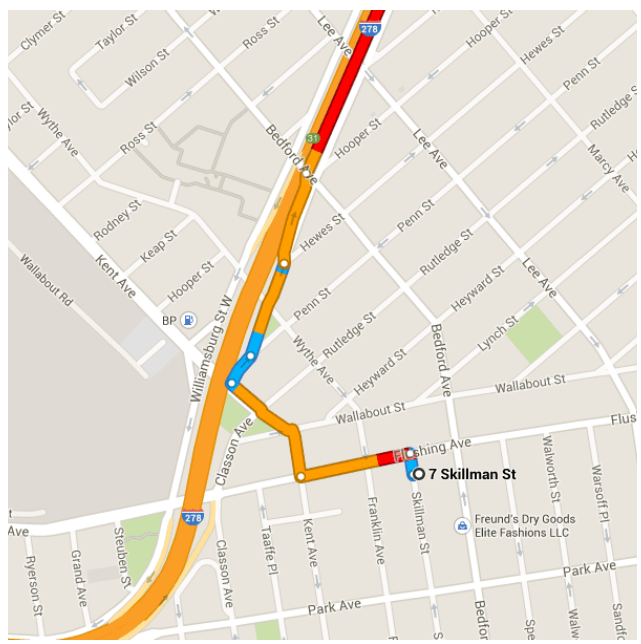


7 Skillman St

Brooklyn, NY 11205

Get on **I-278 E** from **Flushing Ave**, **Kent Ave** and **Williamsburg St E**

0.5 mi / 2 min



1. Head **north** on **Skillman St** toward **Flushing Ave**

   121 ft

2. Turn **left** onto **Flushing Ave**

   0.1 mi

3. Turn **right** at the 2nd cross street onto **Kent Ave**

   0.1 mi

4. Turn **right** onto **Penn St**

   194 ft

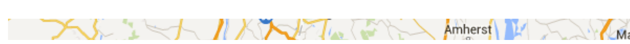
5. Slight **left** onto **Williamsburg St E**

   0.1 mi

6. Take the **Interstate 278 E/Bklyn - Qns Expwy E** ramp on the **left** to **Triboro Br/La Guardia Airport**

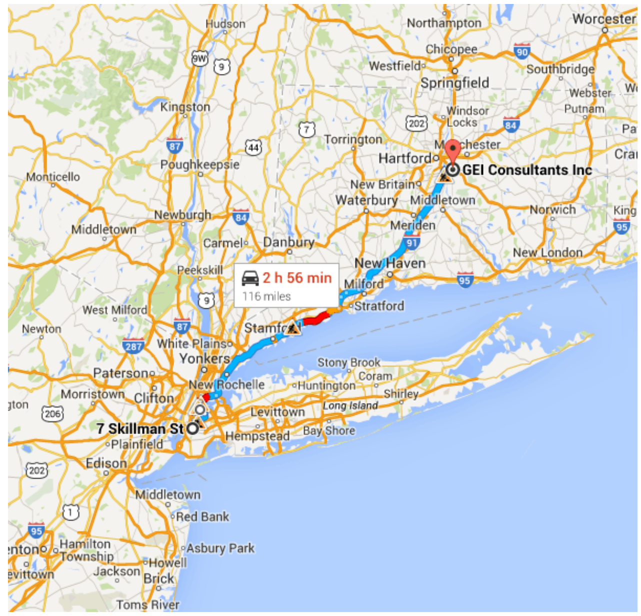
   0.1 mi

Map data ©2015 Google



Continue on **I-278 E**. Take **I-95 N**, **CT-15 N** and **I-91 N** to **CT-94 E/Hebron Ave** in Glastonbury. Take exit **8** from **CT-2 E**

114 mi / 2 h 1 min



7. Merge onto **I-278 E**

2.8 mi

8. Keep **left** to stay on **I-278 E**

2.6 mi

9. Keep **left** at the fork to stay on **I-278 E**, follow signs for **Interstate 278 E/Triboro Br/Bronx**

0.9 mi

10. Take the **I-278** exit on the **left** toward **Triboro Bridge**

⚠ Toll road

0.2 mi

11. Continue onto **I-278 E/Triboro Bridge**

⚠ Partial toll road

3.1 mi

12. Take the exit toward **I-278 E**

164 ft

13. Keep **left** to continue toward **I-278 E**

0.4 mi

14. Continue onto **I-278 E**

4.5 mi

15. Continue onto **I-95 N**

⚠ Partial toll road

ⓘ Entering Connecticut

46.0 mi

16. Take exit **27A** for **Connecticut 25/Connecticut 8** toward **Trumbull/Waterbury**

0.4 mi

17. Continue onto **CT-25 N/CT-8 N**

3.3 mi

18. Keep **right** at the fork to continue on **CT-8 N**, follow signs for **Connecticut 8 N/Connecticut 15 N/Shelton/Waterbury**

1.8 mi

19. Take exit **9** to merge onto **CT-15 N/Merritt Pkwy** toward **CT-15**

3.7 mi

20. Keep **left** to continue on **CT-15 N**

27.0 mi

21. Take exit **68 N-E** to merge onto **I-91 N** toward **CT-66 E/Hartford/Middletown**

14.0 mi

22. Take exit **25-26** to merge onto **CT-3 N** toward **Glastonbury**

2.3 mi

23. Take the exit onto **CT-2 E** toward **Norwich**

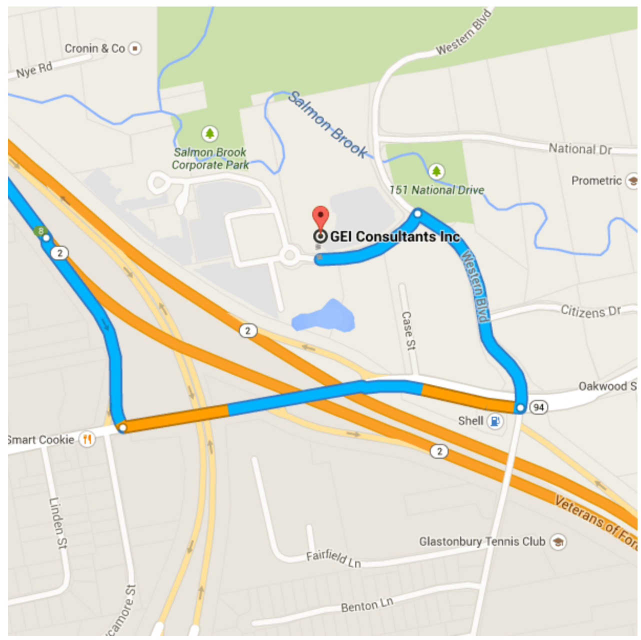
1.0 mi

24. Take exit **8** for **Connecticut 94**

0.2 mi

Continue on **CT-94 E/Hebron Ave**. Drive to **Winding Brook Dr**

0.8 mi / 3 min



25. Turn **left** onto **CT-94 E/Hebron Ave**

0.4 mi

26. Turn **left** onto **Western Blvd**

0.2 mi

27. Turn **left** onto **Winding Brook Dr**

Destination will be on the right

0.1 mi

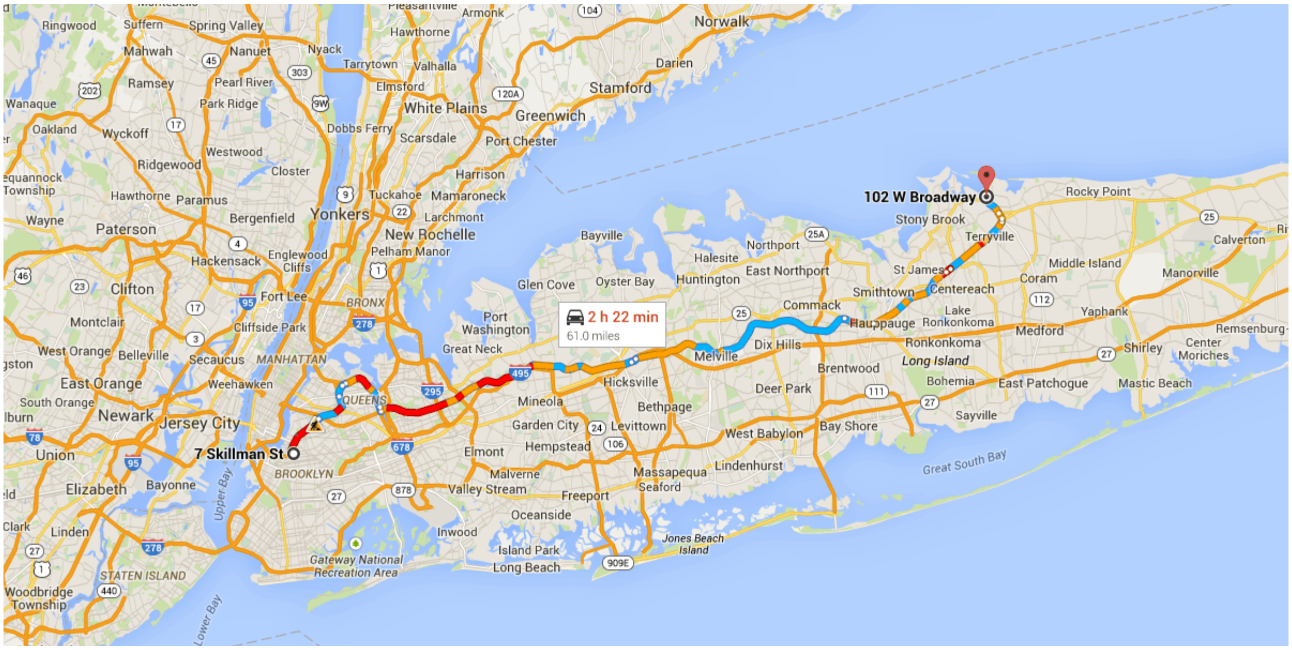
GEI Consultants Inc

455 Winding Brook Drive, Glastonbury, CT 06033

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Google

Directions from **7 Skillman St** to **102 W Broadway**

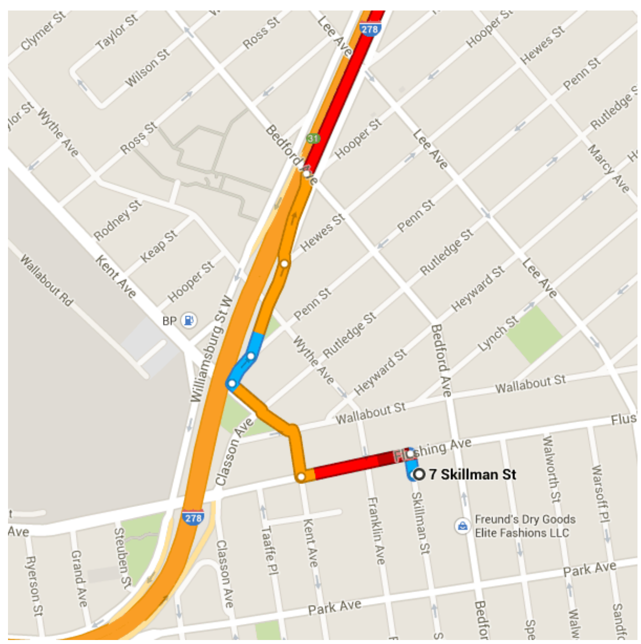


7 Skillman St

Brooklyn, NY 11205

Get on **I-278 E** from **Flushing Ave**, **Kent Ave** and **Williamsburg St E**

0.5 mi / 2 min



1. Head **north** on **Skillman St** toward **Flushing Ave**

121 ft

2. Turn **left** onto **Flushing Ave**

0.1 mi

3. Turn **right** at the 2nd cross street onto **Kent Ave**

0.1 mi

4. Turn **right** onto **Penn St**

194 ft

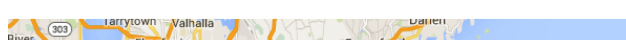
5. Slight **left** onto **Williamsburg St E**

0.1 mi

6. Take the **Interstate 278 E/Bklyn - Qns Expwy E** ramp on the **left** to **Triboro Br/La Guardia Airport**

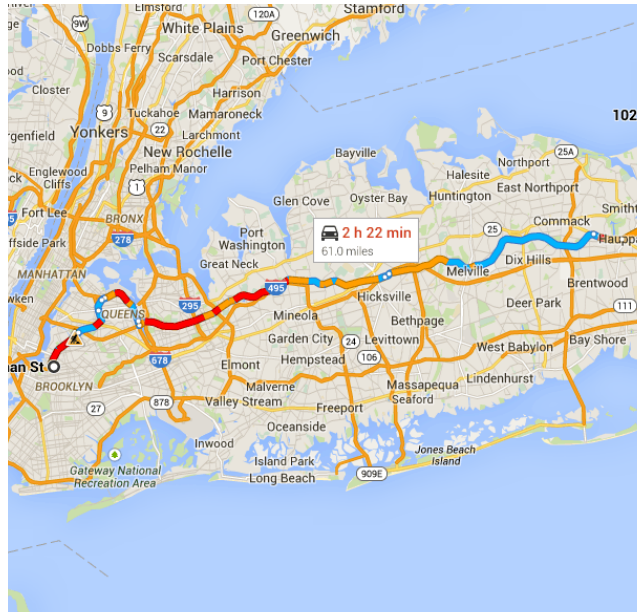
0.1 mi

Map data ©2015 Google



Continue on **I-278 E**. Take **I-495 E** and **Northern State Pkwy** to **NY-347/NY-454 E** in Hauppauge

45.1 mi / 54 min



7. Merge onto **I-278 E**

2.8 mi

8. Keep **left** to stay on **I-278 E**

2.6 mi

9. Keep **right** at the fork to continue on **Brooklyn Queens Expy E**

0.8 mi

10. Take the **Grand Central Pkwy E** exit on the **left** toward **Terminal B/Terminal C/Terminal D**

0.2 mi

11. Merge onto **Grand Central Pkwy**

3.5 mi

12. Take exit **10W-E** for **Interstate 495 E** toward **Eastern Long Island**

0.3 mi

13. Keep **right** at the fork to continue on **Exit 10E**, follow signs for **I-495 E** and merge onto **I-495 E**

18.4 mi

14. Take exit **42** for **Northern Pkwy E/Broadway** toward **Hauppauge**

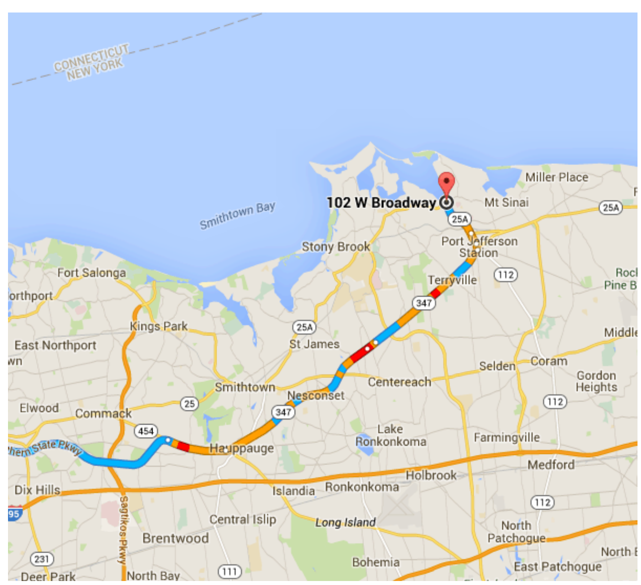
0.4 mi

15. Merge onto **Northern State Pkwy**

16.0 mi

Continue on **NY-347**. Drive to **Main St** in Port Jefferson

15.3 mi / 24 min



16. Merge onto **NY-347/NY-454 E**

2.0 mi

17. Slight **left** onto **NY-347 E** (signs for **New York 347/Port Jefferson**)

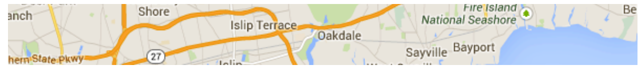
6.2 mi

18. Continue onto **Smithtown Bypass**

0.4 mi

19. Continue onto **NY-347 E**

4.7 mi



20. Slight **left** onto **Jayne Blvd**

0.2 mi

21. Turn **left** onto **Patchogue Rd**

0.4 mi

22. Continue onto **Main St**

1.4 mi

102 W Broadway

Port Jefferson, NY 11777

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix G

Community Air Monitoring Plan

Community Air Monitoring Plan

Skillman Street Former Holder Station - 7 Skillman Street (Site) and the "Bedford Strip" – a 90' by 10' portion of 744 Bedford Avenue

In accordance with the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) requirements for a generic Community Air Monitoring Plan (CAMP), a site-specific CAMP will be implemented at the Site and the Bedford Strip during each phase of the Work. The objective of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors, including residences and businesses and on-site workers not involved with the site field activities) from potential airborne contaminant releases as a direct result of the Work. The CAMP will be a stand-alone document and will be available on Site and on the Bedford Strip.

Air monitoring will be conducted for total volatile organic compounds (TVOCs) and particulates during ground intrusive activities including excavation and materials handling operations. A photoionization detector (PID) will be utilized to monitor the level of TVOCs in the ambient air and a particulate meter will be utilized capable of measuring particulate matter less than 10 micrometers in size (PM-10) in ambient air. Measurements will be monitored from the breathing zone (4 to 5 feet above ground level) at site perimeter locations.

Real-time continuous TVOC and particulates (i.e. dust) monitoring will be conducted during construction activity at up to four locations at the site perimeter. The monitoring locations will be equipped to compare TVOC and PM-10 levels to the response levels, and send a notification to a National Grid representative to evaluate the data and initiate response actions. During short durations of site activity when a National Grid representative is on site, notifications can be made via a visual or audible alarm at each station provided.

The TVOC and PM-10 Monitoring, Response Levels, and Actions are presented as follows:

Air Monitoring Response Levels and Actions

TVOCs

Response Level	Actions
>5 parts per million (ppm) above background for 15-minute average	▪ Temporarily halt work activities ▪ Continue monitoring ▪ If TVOC levels decrease (per instantaneous readings) below 5 ppm over background, work activities can resume.
Persistent levels >5 ppm over background <25 ppm	▪ Halt work activities ▪ Identify source of vapors ▪ Take corrective action to abate emissions ▪ Continue monitoring ▪ If TVOC levels 200 feet downwind of the property boundary or half the distance to the nearest potential receptor is <5 ppm for a 15-minute average, work activities can resume.
>25 ppm	▪ If TVOC levels are >25 ppm at the perimeter of the work area, activities must be shutdown.

Particulates

Response Level	Actions
>100 micrograms per cubic meter (µg/m^3) above background for 15-minute average or visual dust observed leaving the site or the Bedford Strip	▪ Apply dust suppression ▪ Continue monitoring ▪ If downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site or Bedford Strip, work may continue.
>150 µg/m^3 above background for 15-minute average	▪ Stop work ▪ Re-evaluate activities ▪ Continue monitoring ▪ Continue work if downwind PM-10 particulate levels are <150 µg/m^3 above upwind levels and no visual dust leaving site or the Bedford Strip

Sources:

New York State Department of Environmental Conservation, DER-10 / Technical Guidance for Site Investigation Appendix 1A New York State Department of Health Generic Community Air Monitoring Plan, May 2010.

New York State Department of Environmental Conservation, DER-10 / Technical Guidance for Site Investigation Appendix 1B Fugitive Dust and Particulate Monitoring, May 2010.

In order to make a conservative assessment of when different levels of respiratory protection are needed during the fieldwork, it will be assumed that the organic vapors detected by the air monitoring instruments consist of the most toxic volatile compounds expected to be found on the Site and Bedford Strip. Preliminary evaluation of the risks expected at the Site and Bedford Strip indicates that the most toxic volatiles that are probably present are VOCs (particularly benzene, toluene, ethylbenzene, xylene [BTEX]). Based on data published by the Occupational Safety and Health Administration (OSHA) and the American Conference of Government Industrial Hygienists (ACGIH), and experience with MGP wastes, the following personal protective equipment (PPE) will be employed when the given concentrations of organic vapor are detected in the breathing zone.

Compound of Concern	**Level D**	**Level C**	**Level B**
Chemical Name	M<X	X<M<Y	M>Y
BTEX and other photoionizable VOCs	M <5 ppm	5 ppm <M <50 ppm	M >50 ppm

Where: M = concentration of organic vapor measured in the field
X,Y = concentrations at which different levels of respiratory protection are necessary.

The PPE requirements may be modified based on compound-specific monitoring results information.

Respiratory protection from dusts will be required when inhalable particulate concentrations from potentially contaminated sources exceed 150 µg/m$^{3.}$

Odors or dusts derived from on-site contaminants may cause nausea in some site workers, even though the contaminants are at levels well below the safety limits as defined above. Workers may use dust masks or respirators to mitigate nuisance odors with the approval of the site safety officer (SSO).

Whenever practical, work areas should be positioned upwind of organic vapor and dust sources to reduce the potential for worker exposure.

Appendix H

Quality Assurance Project Plan (Electronic Only)

Consulting
Engineers and
Scientists

Revised Quality Assurance Project Plan

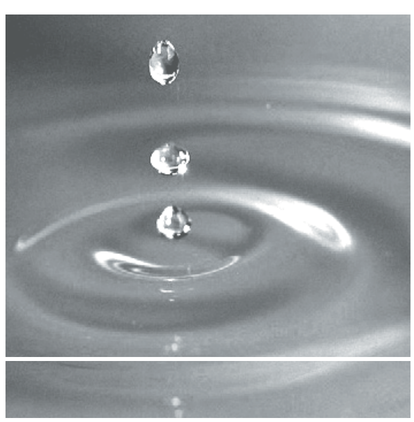
Former Skillman Street Holder Station

Brooklyn, New York
AOC Index No. A2-0552-0606
Site No. 224068

Submitted to:
National Grid
287 Maspeth Avenue
Brooklyn, NY 11211

Submitted by:
GEI Consultants, Inc.
455 Winding Brook Drive, Suite 201
Glastonbury, CT 06033
860-368-5300

May 2016
093080-1-1106



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Appendix

A. TestAmerica Laboratories, Inc. Quality Assurance Manual

MJO:amm

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Abbreviations and Acronyms

ASP	Analytical Service Protocols
ASTM	American Society for Testing and Materials
BGS	Below Ground Surface
CAS	Chemical Abstract Service
CHMM	Certified Hazardous Materials Manager
CMS	Chip Measurement System
CLP	Contract Laboratory Program
COC	Chain-of-Custody
DQO	Data Quality Objective
DO	Dissolved Oxygen
DUSR	Data Usability Summary Report
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc.
ID	Identification
LCS	Laboratory Control Sample
LEL	Lower Explosive Limit
LEP	Licensed Environmental Professional (Connecticut)
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MPH	Master of Public Health
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NYSDEC	New York State Department of Environmental
Conservation NYSDOH	New York State Department of Health
PCB	Polychlorinated Biphenyls
P.G.	Professional Geologist
PID	Photoionization Detector
PM	Project Manager
PQL	Practical Quantification Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCRA	Resource Conservation Recovery Act
RL	Reporting Limit
RPD	Relative Percent Difference
SC	Site Characterization
SD	Standard Deviation
SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TCN	Total Cyanide

Abbreviations and Acronyms (cont.)

TestAmerica	TestAmerica Laboratories, Inc.
TIC	Tentatively Identified Compounds
TOX	Total Organic Halides
TPH	Total Petroleum Hydrocarbons
USDOT	United States Department of Transportation
VOC	Volatile Organic Compound

Quality Assurance Glossary

"Analytical Services Protocol" or "ASP" means the NYSDEC's compendium of approved EPA and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

"Confirmatory Sample" means a sample taken after remedial action is expected to be complete to verify that the cleanup requirements have been met. This term has the same meaning as "post remediation sample".

"Contract laboratory program" or "CLP" means a program of chemical analytical services developed by the EPA to support CERCLA.

"Data Usability Summary Report (DUSR)" is a document that provides a thorough evaluation of the analytical data to determine whether or not the data, as presented, meets the site/project specific criteria for data quality and use.

"Effective solubility" means the theoretical aqueous solubility of an organic constituent in groundwater that is in chemical equilibrium with a separate phase mixed product (product containing several organic chemicals). The effective solubility of a particular organic chemical can be estimated by multiplying its mole fraction in the product mixture by its pure phase solubility.

"Environmental Laboratory Accreditation Program" or "ELAP" means a program conducted by the NYSDOH which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

"Intermediate Sample" means a sample taken during the investigation process that will be followed by another sampling event to confirm that remediation was successful or to confirm that the extent of contamination has been defined to below a level of concern.

"Method detection limit" or "MDL" means the minimum concentration of a substance that can be measured and reported with a 99 percent confidence that the analyte concentration is greater than zero and is determined from the analysis of a sample in a given matrix containing the analyte.

"Non-targeted compound" means a compound detected in a sample using a specific analytical method that is not a targeted compound, a surrogate compound, a system monitoring compound or an internal standard compound.

“Practical quantitation level” or “PQL” means the lowest quantitation level of a given analyte that can be reliably achieved among laboratories within the specified limits of precision and accuracy of a given analytical method during routine laboratory operating conditions.

“PAH” means polycyclic aromatic hydrocarbon as defined by USEPA Method 8270.

“Quality assurance” means the total integrated program for assuring the reliability of monitoring and measurement data, which includes a system for integrating the quality planning, quality assessment and quality improvement efforts to meet data end-use requirements.

“Quality assurance project plan” or “QAPP” means a document which presents in specific terms the policies, organization, objectives, functional activities and specific quality assurance/quality control activities designed to achieve the data quality goals or objectives of a specific project or operation.

“Quality control” means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

“Semivolatile organic compound” means compounds amenable to analysis by extraction of the sample with an organic solvent. For the purposes of this section, semivolatiles are those target compound list compounds identified in the statement of work in the current version of the EPA Contract Laboratory Program.

“Target analyte list” or “TAL” means the list of inorganic compounds/elements designated for analysis as contained in the version of the EPA Contract Laboratory Program Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration in effect as of the date on which the laboratory is performing the analysis. For the purpose of this chapter, a Target Analyte List scan means the analysis of a sample for Target Analyte List compounds/elements.

“Targeted compound” means a hazardous substance, hazardous waste, or pollutant for which a specific analytical method is designed to detect that potential contaminant both qualitatively and quantitatively.

“Target compound list plus 30” or “TCL+30” means the list of organic compounds designated for analysis (TCL) as contained in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis, and up to 30 non-targeted organic compounds (plus 30) as detected by gas chromatography/mass spectroscopy (GC/MS) analysis. For the purposes of this chapter, a Target Compound List+30 scan means the analysis of a sample for Target Compound List compounds and up to 10 non-targeted volatile organic compounds and up to 20 non-targeted semivolatile organic compounds using GC/MS analytical methods. Non-targeted compound criteria should be pursuant to the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"Tentatively identified compound" or "TIC" means a non-targeted compound detected in a sample using a GC/MS analytical method which has been tentatively identified using a mass spectral library search. An estimated concentration of the TIC is also determined.

"Unknown compound" means a non-targeted compound which cannot be tentatively identified. Based on the analytical method used, the estimated concentration of the unknown compound may or may not be determined.

"Volatile organics" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of volatile organics means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 624 or those target compounds identified as volatiles in the version of the EPA "Contract Laboratory Program Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration" in effect as of the date on which the laboratory is performing the analysis.

"**Waste oil"** means used and/or reprocessed engine lubricating oil and/or any other used oil, including but not limited to: fuel oil, engine oil, gear oil, cutting oil, transmission fluid, oil storage tank residue, animal oil and vegetable oil, which has not subsequently been refined.

1. Purpose

GEI Consultants, Inc. (GEI) has prepared this Quality Assurance Project Plan (QAPP) for the Former Skillman Street Holder Station site located at 7 Skillman Street in Brooklyn, New York (Site) and a 10 by 90 foot portion of land on 744 Bedford Avenue immediately adjacent to 7 Skillman Street (the Bedford Strip). The ISMP is a required element of the remedial program and addresses the means for implementing the institutional controls (ICs) and engineering controls (ECs) that are required by the Environmental Easement for the Site. The QAPP and the Field Sampling Plan (FSP) were prepared as companion documents to the ISMP. The project location is shown in Figure 1 of the ISMP. The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and specific quality assurance/quality control (QA/QC) procedures associated with the Skillman Street Former Holder Station Site's ISMP future investigations.

Furthermore, this QAPP identifies project responsibilities, prescribes guidance and specifications to make certain that:

- Samples are identified and controlled through sample tracking systems and chain-of-custody (COC) protocols
- Field and laboratory analytical results are valid and usable by adherence to established protocols and procedures
- Laboratory data are validated so they can be applied to developing a conceptual understanding of the nature and extent of contamination of soils and ground waters at the Site
- All aspects of the investigation, from field to laboratory are documented to provide data that are technically sound and legally defensible

The requirements of this QAPP apply to all contractor activities as appropriate for their respective tasks.

This QAPP was prepared based upon guidance provided by the United States Environmental Protection Agency (EPA) and New York State Department of Environmental Conservation (NYSDEC) including:

- *DER-10, Technical Guidance for Site Investigation and Remediation.* New York State Department of Environmental Conservation. May 2010.

2. Project Goals and Objectives

On behalf of National Grid GEI prepared an Interim Site Management Plan (ISMP) to manage remaining impacts at the former Skillman Street Holder Station site at 7 Skillman Street in the Bedford-Stuyvesant neighborhood of Brooklyn, New York (Site) and a 10 by 90 foot portion of land on 744 Bedford Avenue immediately adjacent to 7 Skillman Street (the Bedford Strip) until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This QAPP was prepared to provide quality assurance guidelines for any additional sampling that may be required for further investigation at the Site. The Site was used to store manufactured gas from 1887 until 1935.

3. Project Organization and Responsibility

GEI is responsible for the implementation of sampling activities, including the supervision of contractors, field activities, and the evaluation and interpretation of data. GEI will direct the sampling activities and coordinate submittal of samples to testing laboratories. The project organization and key personnel for GEI are listed below:

In-House Consultant: Dennis Unites, P.G., LEP
Program Manager: David Terry, P.G., LEP
Project Manager (PM)/Field Team Leader: Melissa Felter
Quality Assurance Officer: Lorie MacKinnon
GEI Corporate Health & Safety Officer: Robin B. DeHate, MPH, PhD(c), CHMM Data
Validator: Lorie Mackinnon
Data Manager: Jaimie Wargo

The primary responsibilities of each of these personnel are described in the following table.

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
In-House Consultant	Dennis Unites	• Provide strategic guidance of project activities • Client contact regarding strategic issues • Review of project deliverables
Program Manager	David Terry	• Overall program oversight • Project management • Project schedule • Client contact regarding project related issues • Personnel and resource management • Review of project submittals • Budgeting
Project Manager/ Field Team Leader	Melissa Felter	• Project management • Client contact regarding project related issues on day to day basis • Coordination of contractors • Technical development and implementation of Work Plan and Field Sampling Plan • Personnel and resource management • Preparation and review of project submittals • Budgeting

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
Quality Assurance Officer	Lorie Mackinnon	• QA/QC for sampling and laboratory performance
Data Validator	Lorie MacKinnon	• Perform data validation activities • Prepare data usability summary reports • Evaluate data with regards to quality objectives
Data Manager	Jaimie Wargo	• Manage raw data from the laboratory

TestAmerica, located in Edison, New Jersey, is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) approved laboratory and will perform standard analytical chemistry parameters for groundwater samples, soil vapor and ambient air, and confirmation soil samples including:

- Volatile Organic Compounds (VOCs) according to EPA Method 8260C
- Semivolatile Organic Compounds (SVOCs) according to EPA Method 8270D
- Target Analyte List (TAL) Metals according to EPA Method 6000/7000 series
- Total Cyanide (TCN) according to EPA Method 9012
- Disposal Parameters (total metals, Toxicity Characteristic Leaching Procedure Metals, Resource Conservation Recovery Act (RCRA) 8 metals, Toxicity Characteristic Leaching Procedure (TCLP) pesticides, TCLP herbicides, TCLP VOC, TCLP SVOC, paint filter test, ignitability, corrosivity, reactivity, total petroleum hydrocarbons (TPH), total polychlorinated biphenyls (PCBs), flashpoint, total organic halides (TOX), and % solids)
- VOCs according to EPA Method TO-15 (including naphthalene)
- Helium by American Society for Testing and Materials (ASTM) Method 1945

TestAmerica's relevant certifications are summarized in the following table.

TestAmerica Certifications		
Location	**Responsible Agency**	**Certification**
New York	New York State Department of Health	Environmental Laboratory Approval Program (ELAP) for potable water/non-potable water, solid and hazardous waste) Contract Laboratory Program (CLP)
	New York State Department of Conservation	Analytical Service Protocol (ASP)
United States	United States Environmental Protection Agency	CLP-Lab:10602 [VOCs/ SVOCs/ Inorganics]

Tables 1 through 3 provide a summary of analysis by media (subsurface soil, groundwater, soil vapor and ambient air). Table 4 provides a summary of quality assurance samples, holding times, and analysis for each media.

4. Quality Assurance Objectives

This section establishes the QA objectives for measurements that are critical to the project. The QA objectives are developed for relevant data quality indicators. These indicators include the method detection limit, reporting limit, precision, accuracy, completeness, representativeness, and comparability. The data quality objectives (DQOs) are based on project requirements and ensure: (1) that the data generated during the project are of known quality, and (2) that the quality is acceptable to achieve the project's technical objectives. All analytical data will be provided by the laboratory using the New York State ASP Category B deliverable format.

Quantitation Limits are laboratory-specific and reflect those values achievable by the laboratory performing the analyses. However, in order to ensure that the analytical methodologies are capable of achieving the DQOs, measurement performance criteria have been set for the analytical measurements in terms of accuracy, precision, and completeness. The analytical methods to be used at this site will provide a level of data quality and can be used to evaluate potential impacts to soil and groundwater from the former holder operation, compared to New York State Standards, Criteria and Guidance values, and also for purposes of risk assessment.

The overall QA objective is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting which will provide results that are scientifically valid, and the levels of which are sufficient to meet DQOs. Specific procedures for sampling, chain-of-custody, laboratory instruments calibration, laboratory analysis, reporting of data, internal quality control, and corrective action are described in other sections of the QAPP.

The data quality indicators are presented in subsections 4.1 through 4.6. Procedures to assess the data quality indicators are given in Section 13.

4.1 Required Quantification Limit

The required quantification limit is the quantitative analytical level for individual analytes needed to make decisions relative to the objectives of the project. Quantitative limits may be expressed as the method detection limit or some quantitative level defined in terms relative to the program. It should be noted that there is some ambiguity in the definitions and use of terms that define quantification limits. The method detection limit (MDL) presented herein is a well-defined and accepted entity, although attainable only under ideal laboratory conditions.

Method Detection Limit: The MDL is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDL is determined from analysis of a sample in a given matrix type containing the analyte.

Practical Quantitation Limit: The practical quantitation limit (PQL) [also referred to as the reporting limit (RL)] is the concentration in the sample that corresponds to the lowest concentration standard of the calibration curve.

Laboratory MDLs and PQLs for soils, groundwater, soil vapor, and ambient air are located in Tables 5 through 7, respectively.

4.2 Accuracy

Accuracy is the closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error.

Accuracy in the field is assessed through the adherence to all field instrument calibration procedures, sample handling, preservation, and holding time requirements, and through the collection of equipment blanks prior to the collection of samples for each type of equipment being used (e.g., sample liners, drilling shoe, or stainless –steel sampling implements).

The laboratory will assess the overall accuracy of their instruments and analytical methods (independent of sample or matrix effects) through the measurement of “standards,” materials of accepted reference value. Accuracy will vary from analysis to analysis because of individual sample and matrix effects. In an individual analysis, accuracy will be measured in terms of blank results, the percent recovery (%R) of surrogate compounds in organic analyses, or %R of spiked compounds in matrix spikes (MSs), matrix spike duplicates (MSDs) and/or laboratory control samples (LCSs). This gives an indication of expected recovery for analytes tending to behave chemically like the spiked or surrogate compounds. The laboratory accuracy will be evaluated in accordance with laboratory quality assurance plan and standard operating procedures located in Appendix A.

4.3 Precision

Precision is the agreement among a set of replicate measurements without consideration of the “true” or accurate value: i.e., variability between measurements of the same material for the same analyte. In environmental sampling, precision is the result of field sampling and analytical factors. Precision in the laboratory is easier to measure and control than precision in the field. Replicate laboratory analyses of the same sample provide information on analytical precision; replicate field samples provide data on overall measurement precision. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision. Precision is measured in a variety of ways including statistically, such as calculating variance or standard deviation. The difference between the overall measurement precision and the analytical precision is attributed to sampling precision.

Precision in the field is assessed through the collection and measurement of field duplicates. Field duplicates will be collected at a frequency of one per twenty investigative samples per matrix per analytical parameter, with the exception of the waste characterization parameters. Precision will be measured through the calculation of relative percent differences (RPDs) as described in subsection 13.2. The resulting information will be used to assess sampling and analytical variability. Duplicate samples are described in subsection 5.1.6. Table 4 summarizes the number of duplicates per media sampled.

Precision in the laboratory is assessed through the calculation of RPD for duplicate samples. For organic analyses, laboratory precision will be assessed through the analysis of MS/MSD samples and field duplicates. For the inorganic analyses, laboratory precision will be assessed through the analysis of matrix duplicate pairs and field duplicate pairs. MS/MSD samples or matrix duplicate pairs will be performed at a frequency of one per 20 primary samples per matrix. Duplicate samples are described in below in subsection 5.1.6. Table 4 summarizes the number of duplicates per media sampled.

4.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. "Normal conditions" are defined as the conditions expected if the sampling plan was implemented as planned. The objective for completeness is a sufficient amount of valid data to achieve a predetermined statistical level of confidence. Critical samples must be identified and plans must be formulated to secure requisite valid data for these samples.

Field completeness is a measure of the amount of (1) valid measurements obtained from all the measurements taken in the project, and (2) valid samples collected. The field completeness objective is greater than 90 percent.

Laboratory completeness is a measure of the amount of valid measurements obtained from all valid samples submitted to the laboratory. The laboratory completeness objective is greater than 95 percent.

To ensure that these percentages are met, materials for crucial parameters will be retained if re-sampling is required and strict adherence to holding times will be required.

4.5 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represent either a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary. To ensure representativeness, the sampling locations have been selected to provide coverage over a wide area and to highlight potential trends in the data.

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that procedures are followed and that proper sampling, sample handling, and sample preservation techniques are used.

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, and meeting sample-holding times. These are provided in Table 4 and within Appendix A.

4.6 Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the procedures are followed and that proper sampling techniques are used. Maximization of comparability with previous data sets is expected because the sampling design and field protocols are consistent with those previously used.

Comparability is dependent on the use of recognized EPA or equivalent analytical methods and the reporting of data in standardized units. To facilitate data comparison, the data-reporting format as presented below will be used:

- Conventions (units reported as): for solids (weight/unit weight [i.e., mg/kg]); for liquids (weight/unit volume [i.e., mg/L]); for air (weight/unit volume [i.e., mg/m3]).
- Use common chemical name with corresponding chemical abstract system (CAS) code.
- Report all data for soils on a dry-weight basis.

5. Sampling Plan

Environmental sampling may include subsurface soil, groundwater, soil vapor and ambient air, confirmation soil and waste characterization sampling. Direct push drilling (Geoprobe®) will be the preferred method for obtaining subsurface soil samples. Groundwater samples will be collected utilizing low-flow sampling methods, peristaltic pumps, bailers, whale pumps, or bladder pumps. Performing grab or composite sampling by appropriate hand-held sampling equipment will be the preferred method for waste characterization sampling. Analytical samples and analysis methods will be described further in the future sampling program's work plan. Sampling methods and procedures will be described in the FSP.

5.1 Sample Type, Location, and Frequency

5.1.1 Subsurface Soil Samples

Subsurface soil sample locations may be sampled using Geoprobe® drilling methods. If difficult drilling conditions are encountered alternative drilling methods such as rotosonic or hollow stem auger drilling methods may be considered. The actual number of subsurface soil samples and their location will be summarized in the future Work Plan and FSP and may be modified based upon subsurface utilities and property access. The number and location of samples will vary based upon access and subsurface obstructions. Soils will be evaluated through visual, olfactory, and field screening observations in accordance with the FSP. Soil samples will be collected and submitted for laboratory analysis in general accordance with the Work Plan and the FSP. A summary of subsurface soil samples and analysis are located in Table 1.

5.1.2 Groundwater Samples

Groundwater monitoring will be performed annually to evaluate trends in the groundwater quality. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Groundwater samples will be collected from seven monitoring wells And/or temporary groundwater sampling points using low-flow methods. Groundwater samples will be collected from wells and temporary groundwater monitoring points screened across the water table or targeted intervals at the proposed sample locations. Ground water samples will be collected and submitted for laboratory analysis in general accordance with the FSP and future work plans. Water quality parameters including temperature, pH, turbidity, dissolved oxygen (DO), and specific conductance, will be collected prior to laboratory analysis in general accordance with the program work plan and the FSP. A summary of groundwater samples and analysis are located in Table 2.

5.1.3 Soil Vapor Samples

Soil vapor sample points may be installed and sampled in general accordance with the New York State Department of Health's "Guidance for Evaluating Soil Vapor Intrusion in the State of New York" and National Grid's "Draft Standard Operating Procedure- Soil Vapor Intrusion for MGP Sites in New York. Sub-slab soil vapor points will be installed to evaluate the soil vapor conditions. Soil vapor samples will be collected in certified clean SUMMA canisters and submitted for laboratory analysis in general accordance with the FSP and program work plans. A summary of soil vapor samples and analysis are located in Table 3.

5.1.4 Ambient Air Samples

Indoor and outdoor air samples may be collected. Ambient air samples are used to assess the potential for soil vapor intrusion into buildings. A summary of ambient air samples and analysis are located in Table 3.

Ambient air samples will be collected from the approximate breathing height (approximately 3 to 5 feet above ground). Indoor air and outdoor air samples will be collected utilizing an individually certified 6-Liter SUMMA canister with a laboratory- supplied flow controller that is calibrated to an 8-hour period. The regulator flow rate will not exceed 0.2 liters per minute. Each SUMMA canister will be shipped to an approved New York State Department of Health (NYSDOH) ELAP registered laboratory for analysis. The samples will be analyzed for VOCs and naphthalene by the modified EPA Method TO-15. QA/QC samples will include one blind duplicate ambient air sample (indoor or outdoor air sample). The ambient air sampling will target the winter heating season between November 15 and March 31 in accordance with NYSDOH Soil Vapor Guidance.

Property information will also be collected in general accordance with the NYSDOH Center of Environmental Health's Indoor Air Quality Questionnaire and Building Form that is provided as Appendix B of the NYSDOH soil vapor guidance and National Grid's Draft Standard Operating Procedures for Soil Vapor Intrusion for Manufactured Gas Plant (MGP) Sites in New York which is located in the FSP.

5.1.5 Investigation-Derived Waste Sample Collection

Waste classification sampling will be conducted as needed for soils and liquid wastes. The purpose of characterizing a waste is for its proper off-site disposal. Composite samples will be collected from the on-site waste storage vessels (drums or roll-off) for parameters required by the approved disposal facility. Soil samples will be collected utilizing stainless steel sampling tools, shovel, or auger that had been decontaminated. Liquid samples will be collected utilizing disposable bailer, peristaltic pump, a pump with tubing, or other similar methods.

These samples will be handled in general accordance with sample handling procedures presented in the FSP. Investigation derived waste samples will be analyzed for parameters listed in Section 3 or other analyses that are required by the National Grid-approved facility.

5.1.6 Field QC Sample Collection

Field QC samples are used to monitor the reproducibility and representativeness of field sampling activities. The field QC samples are handled transported and analyzed in the same manner as the associated field samples. Field QC samples will include equipment blanks, trip blanks, field duplicates and MS/MSDs. The quantity, field QC sample type and analysis is detailed in Table 4.

Equipment Blank Samples are used to monitor the adequacy of decontamination procedures and possible sources of contamination such as potential laboratory methodologies. Equipment blanks will consist of laboratory-supplied, distilled or de-ionized water and will be used to check for potential contamination of the equipment which may cause sample contamination. Equipment blanks will be collected by routing the distilled water through decontaminated piece of sampling equipment or disposable sampling equipment into laboratory supplied bottles. Non-dedicated field equipment will be decontaminated as specified below in subsection 4.3. Equipment blanks will be submitted to the laboratory at a frequency of one per 20 samples per matrix per type of equipment being used per parameter. Equipment blanks will not be completed for waste characterization sampling activities.

Trip Blank Samples will consist of analyte free water and will be prepared by the laboratory. (Trip blanks are used to assess the potential for VOC contamination of samples due to contaminant migration during sample shipment and storage. Trip blanks will be transported to the project location unopened, stored with the site characterization samples, and kept closed until analyzed by the laboratory. Trip blanks will be submitted to the laboratory at a frequency of one per cooler which contains samples submitted for VOC analysis.

Field Duplicate Samples, also referred to as blind duplicate samples, are two samples that are submitted form the same interval using the same sample procedures. Field duplicates will be used to assess the sampling and analytical reproducibility. Both samples are collected utilizing the same methods and are submitted for the same laboratory analysis however different sample identification numbers are used. Field duplicates will be submitted at a frequency of one per 20 samples for all matrices and all parameters. Field duplicates will not be completed for waste characterization sampling activities.

MS/MSD Samples are two additional aliquots of the same sample submitted for the same parameters as the original sample. However, the additional aliquots are spiked with the compounds of concern. Matrix spikes provide information about the effect of the sample matrix on the measurement methodology. MS/MSDs will be submitted at a frequency of one per 20 investigative samples per matrix for organic and inorganic parameters. MS/MSDs will not be completed for waste characterization sampling activities.

Refer to Table 4 for a summary of QC sample preservation and container requirements.

5.2 Sample Preservation and Containerization

The analytical laboratory will supply the sample containers for the chemical samples. These containers will be cleaned by the manufacturer to meet or exceed all analyte specifications established in the latest United States EPA's Specifications and Guidance for Contaminant- Free Sample Containers. Certificates of analysis are provided with each bottle lot and maintained on file to document conformance to EPA specifications. The containers will be pre-preserved, where appropriate (Table 4).

5.3 Equipment Decontamination

All non-dedicated sampling equipment shall be cleaned between each use in the following manner:

- Wash/scrub with a biodegradable degreaser ("Simple Green") if there is oily residue on equipment surface
- Tap water rinse
- Wash and scrub with Alconox (or non-phosphate soap) and water mixture
- Tap water rinse
- All equipment used to collect samples for VOCs and SVOC analysis will then receive a methanol rinse followed by a de-ionized water rinse
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate

The drilling equipment will be decontaminated in general accordance with methods described in the FSP.

Decontamination fluids will be containerized into United States Department of Transportation (USDOT)/UN-approved 55-gallon drums or containment vessels and will be characterized and disposed of by National Grid at an approved disposal facility.

6. Documentation and Chain-of-Custody

6.1 Sample Collection Documentation

6.1.1 Field Notes

Field notes documenting field activities will be maintained in a field notebook in general accordance with subsection 2.2 of the FSP. Field logbooks will provide the means of recording the chronology of data collection activities performed during the investigation. The logbook will be a bound notebook with water-resistant pages. Logbook entries will be dated, legible, and contain accurate and inclusive documentation of the activity. Each page of the logbook will be signed in permanent ink and dated. No erasures or obliterations of field notes will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark which is signed and dated by the sampler. The correction shall be written adjacent to the error.

Field logbooks will be reviewed at regular intervals by the field team leader, site manager, and PM for completeness and representativeness. Logbooks will be supported by daily activity reports as described in subsection 2.3 of the FSP.

6.1.2 Chain-of-Custody Records

Sample custody is discussed in detail below in subsection 6.2. Chain-of-custody records are initiated by the samplers in the field. The field portion of the custody documentation should include:

- The project name
- Signature(s) of sampler (s) responsible for sample custody
- Sample identification (ID) number
- Date and time of collection
- Whether the sample is grab or composite
- Names of individuals involved in sampling
- Air bill or other shipping number (if applicable)

On a regular basis (daily or on such a basis that all holding times will be met), samples will be transferred to the custody of the respective laboratories, via third-party commercial carriers or via laboratory courier service. Sample packaging and shipping procedures, and field chain-of-custody procedures are described below in subsection 6.2.1 of this Plan.

Sample receipt and log-in procedures at the laboratory are described below in subsection 6.2.2 of this Plan.

6.1.3 Sample Labeling

Each sample will be labeled with a pre-printed adhesive label using indelible ink. The label should include the date and time of collection, sampler's initials, tests to be performed, preservative (if applicable), and a unique identification. The following identification scheme will be used:

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES Boring -ID (SAMPLE DEPTH-FEET) SSGP-01 (10-15) **GROUNDWATER SAMPLES** Monitoring Well-ID SSMW-01 Temporary Groundwater Monitoring Point-ID (SAMPLE DEPTH-FEET) SSGW-01 (10-14) **SOIL VAPOR SAMPLES** Soil Vapor-ID SSSV-01 **INDOOR AIR SAMPLES** Indoor Air-ID SSIA-01 **OUTDOOR AIR SAMPLES** Outdoor Air-ID SSOA-01	**FIELD BLANKS** SAMPLE-ID – [DATE] SSGP-FB-033107 SSMW-FB-033107 SSGW-FB-033107 **MATRIX SPIKE/DUP** SAMPLE [ID] [DEPTH] [EITHER MS OR MSD] SSGP-01 (10-15) MS/MSD SSMW-01 (10-15) MS/MSD SSGW-01 (10-15) MS/MSD **TRIP BLANKS** SAMPLE- ID [DATE] SSTB-033107 **BLIND DUPLICATES** SAMPLE -ID[XX][DATE] SSGP-XX-033107 SSMW-XX-033107 SSGW-XX-033107 SSSV-XX-033111

This sample label contains the authoritative information for the sample. Inconsistencies with other documents will be settled in favor of the vial or container label unless otherwise corrected in writing from the field personnel collecting samples or the Data Manager and/or the GEI Project QA Officer.

6.1.4 Sample Handling

Samples will be handled in general accordance with Section 9 of the FSP.

6.2 Sample Custody

The chain-of-custody provides a record of the custody of any environmental field sample from the time of collection to the delivery to the laboratory. Custody is one of several factors that are necessary for the admissibility of environmental data as evidence in a court of law.

Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory analysis, and final evidence files.

A sample is considered to be under a person's custody if

- the item is in the actual possession of a person
- the item is in the view of the person after being in actual possession of the person
- the item was in the actual physical possession of the person but is locked up to prevent tampering
- the item is in a designated and identified secure area

6.2.1 Field Custody Procedures

Samples will be collected following the sampling procedures indicated in the Work Plan and the FSP. A summary of samples and collection methods are provided above in Section 5 of this QAPP. Documentation of sample collection is described above in subsection 6.1. Sample chain-of-custody and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

- The field sampler is personally responsible for the care and custody of the samples until they are transferred or dispatched properly. Field procedures have been designed such that as few people as possible will handle the samples.
- All bottles will be identified by the use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis. The sample numbering system is presented above in subsection 6.1.3.
- Sample labels will be completed for each sample using waterproof ink unless prohibited by weather conditions.
- Samples will be accompanied by a completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a mobile laboratory, and to the laboratory facility.
- All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and placed in the project files.
- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. The custody seals will be attached to the cooler and covered with clear plastic tape after being signed by field personnel.

- If the samples are sent by common carrier, the air bill will be used. Air bills will be retained as part of the permanent documentation. Commercial carriers are not required to sign off on the custody forms since the custody forms will be sealed inside the sample cooler and the custody seals will remain intact.
- Samples remain in the custody of the sampler until transfer of custody is completed. This consists of delivery of samples to the laboratory sample custodian, and signature of the laboratory sample custodian on chain-of-custody document as receiving the samples and signature of sampler as relinquishing samples.

6.2.2 Laboratory Custody Procedures

After accepting custody of the shipping containers, the laboratory will document the receipt of the shipping containers by signing the chain-of-custody record. The laboratory will:

- Examine the shipping containers to verify that the custody tape is intact
- Examine all sample containers for damage
- Determine if the temperature required for the requested testing program has been maintained during shipment and document the temperature on the chain-of-custody records
- Compare samples received against those listed on the chain-of-custody
- Verify that sample holding times have not been exceeded
- Examine all shipping records for accuracy and completeness
- Determine sample pH (if applicable) and record on chain-of-custody forms
- Sign and date the chain-of-custody immediately (if shipment is accepted) and attach the air bill
- Note any problems associated with the coolers and/or samples on the cooler receipt form and notify the laboratory project manager, who will be responsible for contacting the GEI data manager
- Attach laboratory sample container labels with unique laboratory identification and test
- Place the samples in the proper laboratory storage.

Following receipt, samples will be logged in according to the following procedure:

- The samples will be entered into the laboratory tracking system. At a minimum, the following information will be entered: project name or identification, unique sample numbers (both client and internal laboratory), type of sample, required tests, date and time of laboratory receipt of samples, and field ID provided by field personnel.

- The completed chain-of-custody, air bills, and any additional documentation will be placed in the final evidence file.

7. Calibration Procedure

7.1 Field Instruments

Field instruments will be calibrated according to the manufacturer's specifications. Air monitoring instruments will be calibrated to a known reference gas standard and ambient air outside the work zone. Calibration will be completed daily. If concentrations of VOCs are encountered above the reference gas standard, the soil screening photoionization detectors (PID) may be calibrated or re-checked against the reference gas standard. Water quality meters will be calibrated with known reference solutions. All calibration procedures performed will be documented in the field logbook and will include the date/time of calibration, name of person performing the calibration, reference standard used, and the readings. The following equipment has been identified for future use to implement the sampling.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), lower explosive limit (LEL), percent oxygen, hydrogen sulfide and hydrogen cyanide
- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp
- Drager Chip Measurement System (CMS) and compound specific chips (including benzene, hydrogen sulfide, hydrogen cyanide, etc.)
- MIE pDR 1200 with cyclone and pump [particulate monitor]
- MSA LC Pump or SKC 224-PCXR4 [air pump for dust monitoring]
- BIOS Dry Cal DC Lite Primary Flow Meter Model ML [air pump calibration]
  Groundwater Sampling Activities:
- In-Situ Multi-Parameter Troll 9000
- YSI 6280 XLM water quality meter

Soil Vapor and Ambient Air Sampling Activities:

- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp

Similar field equipment can be substituted that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

7.2 Laboratory Instruments

Calibration procedures for a specific laboratory instrument will consist of initial calibrations, initial calibration verifications, and/or continuing calibration verification. Detailed descriptions of the calibration procedures for a specific laboratory instrument are included in the laboratory's quality assurance plan, which describe the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. These procedures are as required in the respective analytical methodologies summarized in Tables 1 through 3 of this QAPP.

8. Sample Preparation and Analytical Procedures

Analytical samples will be collected in general accordance with the FSP and as specified in the program work plan. Tables 1 through 3 provide a sample collection matrix that is separated by media. Analytical samples will be collected into laboratory-preserved sample containers and will be preserved as indicated in Table 4.

9. Data Reduction, Validation, and Reporting

Appropriate QC measures will be used to ensure the generation of reliable data from sampling and analysis activities. Proper collection and organization of accurate information followed by clear and concise reporting of the data is a primary goal in this project. Complete data packages suitable for data validation to support the generation of a Data Usability Summary Report (DUSR) according to NYSDEC requirements will be provided by the analytical laboratory.

9.1 Field Data Evaluation

Measurements and sample collection information will be transcribed directly into the field logbook or onto standardized forms. If errors are made, results will be legibly crossed out, initialed and dated by the person recording the data, and corrected in a space adjacent to the original (erroneous) entry. Reviews of the field records by the field team leader, site manager, and PM will ensure that:

- Logbooks and standardized forms have been filled out completely and that the information recorded accurately reflects the activities that were performed.
- Records are legible and in accordance with good record keeping procedures, i.e., entries are signed and dated, data are not obliterated, changes are initialed, dated, and explained.
- Sample collection, handling, preservation, and storage procedures were conducted in accordance with the protocols described in the FSP and Work Plan, and that any deviations were documented and approved by the appropriate personnel.

9.2 Analytical Data Validation

GEI will be responsible for performing an independent validation of the analytical data. Project-specific procedures will be used to validate analytical laboratory data. The basis for the validation will be the EPA CLP National Functional Guidelines for Organic Data Review (January 2005) and the EPA CLP National Functional Guidelines for Inorganic Data Review (October 2004), modified to accommodate the criteria in the analytical methods used in this program, and Region II Standard Operating Procedures (SOPs) for CLP Organic Data review (Revision 11, June 1996) and Evaluation of Metals for the CLP Program (Revision 11, January 1992). Critical functions for determining the validity of generated data are: (1) strict adherence to the analytical methods, (2) assurance that the instrumentation employed was operated in accordance with defined operating procedures, (3) assurance that quality parameters built into the analytical procedures have been adhered to, and (4) confirmation that the DQOs have been met.

Table 4 highlights the QC criteria and holding time requirements for all analyses conducted under this program. These criteria will be used to evaluate and qualify the data during validation.

GEI or qualified contracted personnel will validate all analytical samples collected as part of the Former Skillman Street Holder Station Site investigations. Samples collected for waste classification will not be validated. Validation will include all technical holding times, as well as QC sample results (blanks, surrogate spikes, laboratory duplicates, MS/MSDs, and LCSs), tunes, internal standards, calibrations, target compound identification, and results calculations.

For all analyses, the laboratory will report results which are below the laboratory's reporting limit; these results will be qualified as estimated (J) by the laboratory. The laboratory may be required to report tentatively identified compounds (TICs) for the VOC and SVOC analyses; this will be requested by GEI on an as-needed basis.

The overall completeness of the data package will also be evaluated by the data validator. Completeness checks will be administered on all data to determine whether full data deliverables were provided. The reviewer will determine whether all required items are present and request copies of missing deliverables.

Upon completion of the validation, a report will be prepared. This report will summarize the samples reviewed, elements reviewed, any nonconformance with the established criteria, and validation actions. Data qualifiers will be consistent with EPA National Functional Guidelines. This report will be in a format consistent with NYSDEC's DUSR.

9.3 Analytical Data Validation

Laboratory deliverables will consist of an original hard copy data package that are in general accordance with NYSDEC ASP Category B data deliverable requirements.

10. Internal Quality Control

Laboratory and field quality internal control checks will be used to ensure the data quality objectives. At a minimum, this will include:

- Matrix spike and/or matrix spike duplicate samples
- Matrix duplicate analyses
- Laboratory control spike samples
- Instrument calibrations
- Instrument tunes for VOC 8260B and SVOC 8270C analyses
- Method and/or instrument blanks
- Surrogate spikes for organic analyses
- Internal standard spikes for VOC 8260B and SVOC 8270C analyses
- Detection limit determination and confirmation by analysis of low-level calibration standard

The laboratory quality plan for TestAmerica is located in Appendix A.

Field quality control samples will include:

- Equipment blanks as outlined in Table 4
- Field duplicate samples as outlined in Table 4
- Trip blanks as outlined in Table 4
- MS/MSDs as outlined in Table 4

11. Performance and System Audits

Audits are an independent means of: 1) evaluating the operation or capability of a measurement system, and 2) documenting the use of QC procedures designed to generate data of know and acceptable quality.

Field audits may be completed to assess sample collection protocols, determine the integrity of COC procedures, and evaluate sample documentation and data handling procedures. Field audits may be scheduled by the QA officer, PM, site manager or in-house consultant, at their discretion. Written records of audits and any recommendations for corrective action will be submitted to the PM.

The QA officer is the interface between management and project activities in matters of project quality. The QA officer will review the implementation of the QAPP. Reviews will be conducted at the completion of field activities and will include the results of any audits and an evaluation of the data quality.

12. Preventive Maintenance

Preventative maintenance will be performed on field equipment in accordance with the manufacturer's recommendations. Preventative maintenance to field will be provided by equipment vendor, U.S. Environmental Rental Corporation, Pine Environmental Services, or other selected vendors. The following equipment has been identified for use to implement the sampling.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 eV lamp), LEL, percent oxygen, hydrogen sulfide and hydrogen cyanide.
- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp.
- RAE Systems VRAE Surveying Monitor with LEL, hydrogen cyanide, hydrogen sulfide, carbon monoxide, and percent oxygen.
- Drager CMS and compound specific chips.
- MIE pDR 1200 with cyclone and pump.
- MSA LC Pump.
- BIOS DCL-5k pump calibrator.

Groundwater Sampling Activities:

- In-Situ Troll 9000
- YSI 600 XLM

Soil Vapor and Ambient Air Sampling Activities:

- RAE Systems MiniRAE 2000 PID with 10.6 eV lamp

Similar equipment will be substituted that perform the same functions can be substituted if selected equipment is not available from equipment supplier.

Laboratory equipment calibration and maintenance procedures are specified in TestAmerica's laboratory quality manual located in Appendix A.

13. Specific Procedures to Assess Data quality Indicators

QC analyses conducted as a part of the testing program will provide a quantitative quality assessment of the data generated and their adherence to the data quality indicators. The data quality indicators ensure that the quality assurance objectives for the project are met.

13.1 Detection Limits

13.1.1 Method Detection Limit

The MDL is defined as follows for all measurements:

MDL = (t[n-1,1-a=0.99]) x (s)

where: s = standard deviation of the replicate analysis,
t(n-1, 1-a=0.99) = student's t-value for a one-sided, 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom

The MDLs calculated by the laboratory are determined under ideal conditions. MDLs for environmental samples are dependent on the sample aliquot, the matrix, the concentration of analyte, and interference present in the matrix, the percent of moisture, dilution factor, etc. The MDL for each sample analysis will be adjusted accordingly.

13.1.2 Reporting Limit

The RL is the concentration of an analyte in the sample that corresponds to the lowest concentration standard of the calibration curve. As with the MDLs, the RLs are dependent on the sample aliquot, the final sample volume, the percent of moisture, dilution factor, etc.

$$RL = \frac{\text{Lowest conc. std (ng)}}{\text{Volume injected (uL)}} x \frac{\text{Sample aliquot (mL or g)}}{\text{Final volume (mL)}} x\ DF\ x \frac{100}{(100 - \%M)}$$

The RL is determined as follows:

where: DF = dilution factor, including all dilutions or lost samples not accounted for in a sample aliquot/final volume ratio
%M = percent moisture for solid samples.

13.2 Precision

Variability will be expressed in terms of the RPD when only two data points exist. The RPD is calculated as:

$$RPD = \frac{(Larger\ Value - Smaller\ Value)}{[(Larger\ Value + Smaller\ Value)/2]} x\ 100\%$$

For data sets greater than two points, the percent relative standard deviation (percent RSD) is used as the precision measurement. It is defined by the equation:

$$Percent\ RSD = \frac{Standard\ Deviation}{Mean} x\ 100\%$$

Standard deviation (SD) is calculated as follows:

$$SD = \sqrt{\sum_{i=1}^{n} \frac{(y_i - y)^2}{n - 1}}$$

where: SD = standard deviation
yi = measured value of the ith replicate
y = mean of replicate measurements
n = number of replicates

For measurements such as pH, where the absolute variation is more appropriate, precision is usually reported as the absolute range (D) of duplicate measurements:

$$D = \left| \text{first measurement - second measurement} \right|$$

or as the absolute standard deviation previously given. RPD, %RSD, and D are independent of the error of the analyses and reflect only the degree to which the measurements agree with each other, not the degree to which they agree with the true value for the parameter measured.

13.3 Accuracy

Accuracy is related to the bias in a measurement system. Accuracy describes the degree of agreement of a measurement with a true value. Accuracy will be expressed as percent recovery for each matrix spike analyte by using the following equation:

$$\%\ Recovery = \frac{Css - Cus}{Csa}\ X\ 100\%$$

where: Css = measured concentration in spiked sample
Cus = measured concentration in unspiked sample
Csa = known concentration added to the sample

Accuracy for a measurement such as pH is expressed as bias in the analysis of a standard reference sample according to the equation:

$$\text{Bias} = pH_m - pH_t$$

where: pH_m = measured pH
pH_t = the true pH of the standard reference sample

13.4 Completeness

Data completeness is a measure of the amount of usable data resulting from a measurement effort. For this program, completeness will be defined as the percentage of valid data obtained compared to the total number of measurements necessary to achieve our required statistical level of confidence for each test. The confidence level is based on the total number of samples proposed in the Work Plan.

Data completeness is calculated as:

$$Completeness = \frac{Number\ of\ valid\ data\ points}{Number\ of\ data\ points\ necessary\ for\ confidence\ level} x\,100\%$$

The completeness goal is to generate a sufficient amount of valid data. GEI anticipates that 95 percent of the data will be complete. Data validation criteria discussed in the work plan and Section 10 of this QAPP will be used to determine data completeness. Any data deficiencies and their effect on project goals will be evaluated in the DUSR.

13.5 Representativeness

Representativeness is a qualitative statement that expresses the extent to which the sample accurately and precisely represents the characteristics of interest of the study. Representativeness is primarily concerned with the proper design of the sampling program and is best ensured by proper selection of sampling locations and the taking of a sufficient number of samples. It is addressed by describing the sampling techniques, the matrices sampled, and the rationale for the selection of sampling locations, which are discussed in the field sampling plan and Work Plan

13.6 Comparability

Comparability is a qualitative parameter expressing the confidence that one set of data can be compared to another. Comparability is possible only when standardized sampling and analytical procedures are used.

14. Corrective Action

If unacceptable conditions are identified as a result of audits or are observed during field sampling and analysis, the PM, Field Team Leader, and QA officer will document the condition and initiate corrective procedures. The specific condition or problem will be identified, its cause will be determined, and appropriate action will be implemented.

The entire sampling program will be under the direction of the PM and QA officer. The emphasis in this program is on preventing problems by identifying potential errors, discrepancies, and gaps in the data collection, laboratory analysis, and interpretation process. Any problems identified will be promptly resolved. Likewise, follow-up corrective action is always an option in the event that preventative corrective actions are not effective.

The acceptance limits for the sampling and analyses to be conducted in this program will be those stated in the method or defined by other means in the program work plan and FSP. Corrective actions are likely to be immediate in nature and most often will be implemented by the contracted laboratory analyst or the PM. The corrective action will usually involve recalculation, reanalysis, or repeating a sample run.

14.1 Immediate Corrective Action

Corrective action in the field may be needed when the sample requirements are changed (i.e., more/less samples, sampling locations other than those specified in the program work plan), or when sampling procedures and/or field analytical procedures require modification, etc. due to unexpected conditions. The field team may identify the need for corrective action. The Field Team Leader, Site Manager and PM will approve the corrective action and notify the QA officer. The PM and QA officer will approve the corrective measure. The Field Team Leader and Site Manager will ensure that the corrective measure is implemented by the field team.

Corrective actions will be implemented and documented in the field record book. Documentation will include:

- A description of the circumstances that initiated the corrective action
- The action taken in response
- The final resolution
- Any necessary approvals

No staff member will initiate corrective action without prior communication of findings through the proper channels.

Corrective action in the laboratory will be completed in accordance with the quality assurance procedures located in the Appendix A. Any corrective actions completed by the laboratory will be documented in both the laboratory's corrective action files, and the narrative data report sent from the laboratory to the PM. If the corrective action does not rectify the situation, the laboratory will contact the PM, who will determine the action to be taken and inform the appropriate personnel.

If potential problems are not solved as an immediate corrective action, the contractor will apply formalized long-term corrective action if necessary.

Tables

Table 1
Subsurface Soil Field Sampling Matrix
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Sample I.D.	Sample Location	Laboratory Sample Description	Sample Rationale	Sampling Medium		TCL VOCs (EPA 8260C)	TCL SVOCs (EPA 8270D)	TAL Metals (EPA 6010)	Total Cyanide (EPA 9012)	Free Cyanide (EPA 9016)
				Field Observations[1]	Soil					
SSGP-XX	TBD	TBD	TBD	X	X	X	X	X	X	X
SSSB-XX	TBD	TBD	TBD	X	X	X	X	X	X	X

NOTES:

[1] : Field observations include visual (e.g. staining, sheen, and discolorization) and olfactory observations. Field observations will be recorded in field n

Chemical analysis test methods specified are from U.S. EPA SW-846 test methods

EPA - Environmental Protection Agency

SVOCs - semivolatile organic compounds

TAL - target analyte list

VOCs - volatile organic compounds

Table 2
Groundwater Field Sampling Matrix
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Sample I.D.	Sample Location	Laboratory Sample Description	Sample Rationale	Sampling Medium		Water Quality Measurements							TCL VOCs (EPA 8260C)	TCL SVOCs (EPA 8270D)	TAL Metals (EPA 6010)	Total Cyanide (EPA 9012)
				Field Observations[1]	Groundwater	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Salinity	Dissolved Oxygen				
SSMW-XX	TBD	TBD	TBD	X	X	X	X	X	X	X	X	X	X	X	X	X

NOTES:
[1] : Field observations include visual (e.g. staining, sheen, and discolorization) and olfactory observations. Field observations will be recorded in field notes.
Chemical analysis test methods specified are from U.S. EPA SW-846 test methods
EPA - Environmental Protection Agency
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds

Table 3
Soil Vapor and Ambient Air Field Sampling Matrix
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Sample I.D.	Sample Location	Laboratory Sample Description	Sample Rationale	Sampling Medium		VOCs (EPA TO-15)
				Field Observations[1]	Soil Vapor / Air	
SSSV-XX	TBD	TBD	TBD	X	X	X
SSIA-XX	TBD	TBD	TBD	X	X	X
SSOA-XX	TBD	TBD	TBD	X	X	X

SAMPLE SELECTION PROTOCOL:
1. Collect one soil vapor sample at the installed soil vapor point depth.
2. Collect indoor and outdoor air samples from the height of the breathing zone, approximately 3-5 feet above the ground surface

NOTES:
[1] : Field observations include visual (e.g. staining, sheen, and discoloration) and olfactory observations. Field observations will be recorded in field notes.
Chemical analysis test methods specified are from U.S. EPA Expanded Modified Method TO-15
VOCs - volatile organic compounds

Table 4
Analytical Methods/Quality Assurance Summary Table
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[2]	DUP	MS/MSD						
Groundwater[1]	7	1	1	1	1	11	VOCs	8260B	pH<2 with HCl, Cool to 4°C	14 days to analysis	(2) 40 mL VOA vials
	7	0	1	1	1	10	SVOCs	8270C	Cool to 4°C	7 days to extraction; 40 days from extraction to analysis	(2) 1 L amber glass jar
	7	0	1	1	1	10	TAL Metals	6000/7000	pH<2 with HNO_3; Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	(1) 500 mL polyethylene container
	7	0	1	1	1	10	Total Cyanide	9012	NaOH to pH>12/Cool to 4°C	14 days to analysis	(1) 500 mL polyethylene container
Soil Vapor	TBD	0	0	1	0	TBD	VOCs	TO-15	None	30 days to analysis	Summa canister
Indoor/Outdoor Air	TBD	0	0	0	0	TBD	VOCs	TO-15	None	30 days to analysis	Summa canister

NOTES:
[1]: Groundwater samples summary based upon only one sampling event.
VOCs - volatile organic compounds
SVOCs - semivolatile organic compounds
TAL - target analyte list
ASTM - American Society for Testing and Materials
°C- Degrees Celsius
L - Liter
mL - Milliliter
HNO3 - Nitric acid
HCl - Hydrochloric Acid
NAOH - Sodium Hydroxide

Table 5
Quantification Limits for Subsurface Soil
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260C			
1,1,1-Trichloroethane	5	0.84	ug/Kg
1,1,2,2-Tetrachloroethane	5	1.21	ug/Kg
1,1,2-Trichloroethane	5	1.04	ug/Kg
1,1-Dichloroethane	5	0.81	ug/Kg
1,1-Dichloroethene	5	1.09	ug/Kg
1,2,3-Trichloropropane	5	1.62	ug/Kg
1,2,4-Trichlorobenzene	5	0.61	ug/Kg
1,2-Dichloroethane	5	0.99	ug/Kg
1,2-Dichloropropane	5	1.06	ug/Kg
2-Butanone (MEK)	10	1.78	ug/Kg
2-Chloroethylvinylether	5	1.37	ug/Kg
2-Hexanone	10	2.53	ug/Kg
4-Methyl-2-pentanone (MIBK)	5	1.18	ug/Kg
Acetone	20	3.15	ug/Kg
Acrolein	20	3.1	ug/Kg
Acrylonitrile	5	1.19	ug/Kg
Benzene	5	0.86	ug/Kg
Bromodichloromethane	5	0.84	ug/Kg
Bromoform	5	0.99	ug/Kg
Bromomethane	5	0.82	ug/Kg
Carbon disulfide	5	0.61	ug/Kg
Carbon tetrachloride	5	0.78	ug/Kg
Chlorobenzene	5	0.79	ug/Kg
Chloroethane	5	1.89	ug/Kg
Chloroform	5	0.53	ug/Kg
Chloromethane	5	0.9	ug/Kg
cis-1,2-Dichloroethene	5	1.04	ug/Kg
cis-1,3-Dichloropropene	5	0.78	ug/Kg
Dibromochloromethane	5	0.41	ug/Kg
Dichlorodifluoromethane	5	1.25	ug/Kg
Ethylbenzene	5	0.79	ug/Kg
Isopropyl ether	5	0.44	ug/Kg
Methylene chloride	20	2.21	ug/Kg
Methyl-tert-butyl-ether (MTBE)	5	0.93	ug/Kg
Styrene	5	1.06	ug/Kg
tert-Butyl alcohol	20	4.69	ug/Kg
Tetrachloroethene	5	0.7	ug/Kg
Toluene	5	0.84	ug/Kg
trans-1,2-Dichloroethene	5	0.58	ug/Kg
trans-1,3-Dichloropropene	5	0.92	ug/Kg
Trichloroethene	5	0.68	ug/Kg
Trichlorofluoromethane	5	0.6	ug/Kg
Trichlorotrifluoroethane	5	0.63	ug/Kg
Vinyl acetate	10	2.7	ug/Kg
Vinyl chloride	5	0.87	ug/Kg
Xylenes (total)	5	1.96	ug/Kg
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D			
1,2,4-Trichlorobenzene	333	55.96	ug/Kg
1,2-Dichlorobenzene	333	56.43	ug/Kg
1,2-Diphenylhydrazine	333	32.86	ug/Kg
1,3-Dichlorobenzene	333	50.49	ug/Kg
1,4-Dichlorobenzene	333	52.75	ug/Kg
2,2-oxybis (1-chloropropane)	333	47.18	ug/Kg
2,4,5-Trichlorophenol	1667	120.96	ug/Kg
2,4,6-Trichlorophenol	333	85.18	ug/Kg
2,4-Dichlorophenol	333	108.95	ug/Kg
2,4-Dimethylphenol	333	172.3	ug/Kg
2,4-Dinitrophenol	1667	114.87	ug/Kg
2,4-Dinitrotoluene	333	60.09	ug/Kg
2,6-Dinitrotoluene	333	60.57	ug/Kg
2-Chloronaphthalene	333	48.46	ug/Kg
2-Chlorophenol	333	86.27	ug/Kg
2-Methylnaphthalene	333	52.92	ug/Kg
2-Methylphenol	333	89.03	ug/Kg
2-Nitroaniline	1667	42.32	ug/Kg
2-Nitrophenol	333	115.71	ug/Kg
3,3-Dichlorobenzidine	667	88.96	ug/Kg
3-Nitroaniline	1667	68.54	ug/Kg
4,6-Dinitro-2-methylphenol	1667	239.28	ug/Kg
4-Bromophenyl phenyl ether	333	51.16	ug/Kg

Table 5
Quantification Limits for Subsurface Soil
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D (Continued)			
4-Chloro-3-methylphenol	333	112.76	ug/Kg
4-Chloroaniline	333	107.34	ug/Kg
4-Chlorophenyl phenyl ether	333	45.74	ug/Kg
4-Methylphenol	333	179.39	ug/Kg
4-Nitroaniline	667	48.17	ug/Kg
4-Nitrophenol	1667	141.69	ug/Kg
Acenaphthene	333	55.32	ug/Kg
Acenaphthylene	333	40.59	ug/Kg
Aniline	333	73.83	ug/Kg
Anthracene	333	54.55	ug/Kg
Benzidine	3333	1134.9	ug/Kg
Benzo(a)anthracene	333	45.31	ug/Kg
Benzo(a)pyrene	333	41.16	ug/Kg
Benzo(b)fluoranthene	333	93.11	ug/Kg
Benzo(ghi)perylene	333	36.99	ug/Kg
Benzo(k)fluoranthene	333	37.12	ug/Kg
Benzoic acid	1667	90.33	ug/Kg
Benzyl alcohol	333	62.93	ug/Kg
Bis(2-chloroethoxy)methane	333	57.03	ug/Kg
Bis(2-chloroethyl)ether	333	44.86	ug/Kg
Bis(2-ethylhexyl)phthalate	333	44.37	ug/Kg
Butyl benzyl phthalate	333	43.04	ug/Kg
Carbazole	333	48.63	ug/Kg
Chrysene	333	41.6	ug/Kg
Dibenzo(a,h)anthracene	333	36.71	ug/Kg
Dibenzofuran	333	52.67	ug/Kg
Diethyl phthalate	333	48.88	ug/Kg
Dimethyl phthalate	333	51.27	ug/Kg
Di-n-butyl phthalate	333	43.98	ug/Kg
Di-n-octyl phthalate	333	34.97	ug/Kg
Fluoranthene	333	41.87	ug/Kg
Fluorene	333	43.39	ug/Kg
Hexachlorobenzene	333	48.52	ug/Kg
Hexachlorobutadiene	333	67.85	ug/Kg
Hexachlorocyclopentadiene	333	247.96	ug/Kg
Hexachloroethane	333	59.22	ug/Kg
Indeno(1,2,3-cd)pyrene	333	33.74	ug/Kg
Isophorone	333	60.02	ug/Kg
Naphthalene	333	56.66	ug/Kg
Nitrobenzene	333	40.4	ug/Kg
n-Nitrosodimethylamine	333	48.87	ug/Kg
n-Nitroso-di-n-propylamine	333	44.63	ug/Kg
n-Nitrosodiphenylamine	333	49.76	ug/Kg
Pentachlorophenol	1667	287.85	ug/Kg
Phenanthrene	333	38.58	ug/Kg
Phenol	333	96.98	ug/Kg
Pyrene	333	45.56	ug/Kg
Pyridine	667	39.9	ug/Kg
Metals by EPA Method 6000/7000 series			
Aluminum	258	20	mg/Kg
Antimony	11.7	1.14	mg/Kg
Arsenic	8	1.22	mg/Kg
Barium	2	0.18	mg/Kg
Beryllium	2	0.5	mg/Kg
Cadmium	3	1	mg/Kg
Calcium	85	11.6	mg/Kg
Chromium	3	0.34	mg/Kg
Cobalt	2	0.42	mg/Kg
Copper	5	0.8	mg/Kg
Iron	145	10.2	mg/Kg
Lead	9	0.76	mg/Kg
Magnesium	35	9.2	mg/Kg
Manganese	2.5	0.64	mg/Kg
Mercury	0.05	0.02	mg/Kg
Nickel	6.25	0.44	mg/Kg
Potassium	200	40	mg/Kg
Selenium	16	1.6	mg/Kg
Silver	3	0.32	mg/Kg
Sodium	94	20	mg/Kg
Thallium	20	4.17	mg/Kg
Vanadium	4	0.36	mg/Kg
Zinc	20	3.8	mg/Kg

Table 5
Quantification Limits for Subsurface Soil
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Free Cyanide by EPA Method 9013/ ASTM D4282-02			
Free Cyanide	TBD	TBD	ug/Kg

NOTES:
mg/kg - miligrams per killogram
ug/kg - micrograms per killogram
TBD - To Be Determined
EPA - Environmental Protection Agency
ASTM - American Standard for Testing and Materials

Table 6
Quantification Limits for Groundwater
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Volatile Organic Compounds (VOCs) by EPA Method 8260C			
1,1,1-Trichloroethane	5	0.4	ug/L
1,1,2,2-Tetrachloroethane	5	0.4	ug/L
1,1,2-Trichloroethane	5	0.6	ug/L
1,1-Dichloroethane	5	0.6	ug/L
1,1-Dichloroethene	5	0.7	ug/L
1,2,3-Trichloropropane	5	1.1	ug/L
1,2,4-Trichlorobenzene	5	0.9	ug/L
1,2-Dichloroethane	5	0.6	ug/L
1,2-Dichloropropane	5	0.9	ug/L
1,3-Dichloropropane	5	0.4	ug/L
2-Butanone (MEK)	5	1.2	ug/L
2-Chloroethylvinylether	5	0.6	ug/L
2-Hexanone	5	0.8	ug/L
4-Methyl-2-pentanone (MIBK)	5	0.7	ug/L
Acetone	5	1.4	ug/L
Acrolein	10	7.8	ug/L
Acrylonitrile	5	1.6	ug/L
Benzene	5	0.4	ug/L
Bromodichloromethane	5	0.4	ug/L
Bromoform	5	0.8	ug/L
Bromomethane	5	1.2	ug/L
Carbon disulfide	5	0.9	ug/L
Carbon tetrachloride	5	1	ug/L
Chlorobenzene	5	0.4	ug/L
Chloroethane	5	0.8	ug/L
Chloroform	5	0.7	ug/L
Chloromethane	5	0.5	ug/L
cis-1,2-Dichloroethene	5	0.6	ug/L
cis-1,3-Dichloropropene	5	0.5	ug/L
Dibromochloromethane	5	0.5	ug/L
Dichlorodifluoromethane	5	0.6	ug/L
Ethylbenzene	5	1	ug/L
Isopropyl ether	5	N/A	ug/L
Methylene chloride	5	0.4	ug/L
Methyl-tert-butyl-ether (MTBE)	5	0.3	ug/L
Styrene	5	0.5	ug/L
Tetrachloroethene	5	0.5	ug/L
Toluene	5	0.3	ug/L
trans-1,2-Dichloroethene	5	0.5	ug/L
trans-1,3-Dichloropropene	5	0.3	ug/L
Trichloroethene	5	0.7	ug/L
Trichlorofluoromethane	5	0.6	ug/L
Trichlorotrifluoroethane	5	0.5	ug/L
Vinyl acetate	5	0.2	ug/L
Vinyl chloride	5	0.8	ug/L
Xylenes (total)	5	1	ug/L
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D			
1,2,4-Trichlorobenzene	10	0.68	ug/L
1,2-Dichlorobenzene	10	0.74	ug/L
1,2-Diphenylhydrazine	10	0.84	ug/L
1,3-Dichlorobenzene	10	0.68	ug/L
1,4-Dichlorobenzene	10	0.46	ug/L
2,2-oxybis (1-chloropropane)	10	0.62	ug/L
2,4,5-Trichlorophenol	50	0.78	ug/L
2,4,6-Trichlorophenol	10	0.79	ug/L
2,4-Dichlorophenol	10	0.84	ug/L
2,4-Dimethylphenol	10	0.73	ug/L
2,4-Dinitrophenol	50	5.13	ug/L
2,4-Dinitrotoluene	10	0.8	ug/L
2,6-Dinitrotoluene	10	0.59	ug/L
2-Chloronaphthalene	10	0.73	ug/L
2-Chlorophenol	10	0.6	ug/L
2-Methylnaphthalene	10	0.64	ug/L
2-Methylphenol	10	0.59	ug/L
2-Nitroaniline	50	1.12	ug/L
2-Nitrophenol	10	0.75	ug/L
3,3-Dichlorobenzidine	10	0.98	ug/L
3-Nitroaniline	50	0.67	ug/L

Table 6
Quantification Limits for Groundwater
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Semivolatile Organic Compounds (SVOCs) by EPA Method 8270D (Continued)			
4,6-Dinitro-2-methylphenol	50	4.24	ug/L
4-Bromophenyl phenyl ether	10	0.91	ug/L
4-Chloro-3-methylphenol	10	0.51	ug/L
4-Chloroaniline	10	0.43	ug/L
4-Chlorophenyl phenyl ether	10	0.82	ug/L
4-Methylphenol	10	0.33	ug/L
4-Nitroaniline	20	1.05	ug/L
4-Nitrophenol	50	1.85	ug/L
Acenaphthene	10	0.8	ug/L
Acenaphthylene	10	0.75	ug/L
Aniline	10	0.63	ug/L
Anthracene	10	0.99	ug/L
Benzidine	100	2.15	ug/L
Benzo(a)anthracene	10	1.19	ug/L
Benzo(a)pyrene	10	1.08	ug/L
Benzo(b)fluoranthene	10	1.54	ug/L
Benzo(ghi)perylene	10	1.04	ug/L
Benzo(k)fluoranthene	10	0.91	ug/L
Benzoic acid	50	5.88	ug/L
Benzyl alcohol	10	0.99	ug/L
Bis(2-chloroethoxy)methane	10	0.87	ug/L
Bis(2-chloroethyl)ether	10	0.87	ug/L
Bis(2-ethylhexyl)phthalate	10	1.31	ug/L
Butyl benzyl phthalate	10	0.96	ug/L
Carbazole	10	1.11	ug/L
Chrysene	10	0.97	ug/L
Dibenzo(a,h)anthracene	10	1.34	ug/L
Dibenzofuran	10	0.82	ug/L
Diethyl phthalate	10	0.82	ug/L
Dimethyl phthalate	10	0.63	ug/L
Di-n-butyl phthalate	10	1.14	ug/L
Di-n-octyl phthalate	10	1.3	ug/L
Fluoranthene	10	1.08	ug/L
Fluorene	10	0.77	ug/L
Hexachlorobenzene	10	1.07	ug/L
Hexachlorobutadiene	10	0.84	ug/L
Hexachlorocyclopentadiene	10	2.21	ug/L
Hexachloroethane	10	1.06	ug/L
Indeno(1,2,3-cd)pyrene	10	1.17	ug/L
Isophorone	10	0.66	ug/L
Naphthalene	10	0.66	ug/L
Nitrobenzene	10	0.79	ug/L
n-Nitroso-di-n-propylamine	10	0.7	ug/L
n-Nitrosodiphenylamine	10	1.08	ug/L
n-Nitrosomethylethylamine	10	0.5	ug/L
Pentachlorophenol	50	5.04	ug/L
Phenanthrene	10	0.66	ug/L
Phenol	10	0.35	ug/L
Pyrene	10	1.01	ug/L
Pyridine	20	2.31	ug/L
Target Analyte List (TAL) Metals by EPA Method 6000/7000 series			
Aluminum	500	92	ug/L
Antimony	20	5.4	ug/L
Arsenic	40	3.9	ug/L
Barium	5	0.74	ug/L
Beryllium	5	0.54	ug/L
Cadmium	10	1.1	ug/L
Calcium	300	56	ug/L
Chromium	10	1.3	ug/L
Cobalt	10	1.8	ug/L
Copper	10	4.3	ug/L
Iron	100	54	ug/L
Lead	10	3	ug/L
Magnesium	100	26	ug/L
Manganese	15	6.9	ug/L
Mercury	0.4	0.07	ug/L
Nickel	10	1.9	ug/L
Potassium	400	191	ug/L
Selenium	30	5	ug/L
Silver	6	1.1	ug/L
Sodium	400	98	ug/L

Table 6
Quantification Limits for Groundwater
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	Reporting Limit	Method Detection Limit	Units
Thallium	40	10	ug/L
Target Analyte List (TAL) Metals by EPA Method 6000/7000 series (Continued)			
Vanadium	6	1.5	ug/L
Zinc	50	11	ug/L
Cyanide by EPA Method 9012			
Cyanide, Total	10	1	ug/L

NOTES:
ug/L - micrograms per liter
EPA - Environmental Protection Agency

Table 7
Quantification Limits for Soil Vapor and Ambient Air
Quality Assurance Project Plan
Former Skillman Street Holder Station
Brooklyn, New York

Analytes	ppb		ug/m3	
	Reporting Limit	Method Detection Limit	Reporting Limit	Method Detection Limit
Volatile Organic Compounds (VOCs) by Modified TO-15				
1,1,1-Trichloroethane	0.080	0.012	0.44	0.065
1,1,2,2-Tetrachloroethane	0.080	0.024	0.55	0.16
1,1,2-Trichloro-1,2,2-trifluoroethane	0.080	0.012	0.61	0.092
1,1,2-Trichloroethane	0.080	0.021	0.44	0.11
1,1-Dichloroethane	0.080	0.010	0.32	0.040
1,1-Dichloroethene	0.080	0.014	0.32	0.056
1,2,4-Trichlorobenzene	0.40	0.039	3.0	0.29
1,2,4-Trimethylbenzene	0.080	0.025	0.39	0.12
1,2-Dibromoethane (EDB)	0.080	0.018	0.61	0.14
1,2-Dichloro-1,1,2,2-tetrafluoroethane	0.080	0.013	0.56	0.091
1,2-Dichlorobenzene	0.080	0.028	0.48	0.17
1,2-Dichloroethane	0.080	0.019	0.32	0.077
1,2-Dichloropropane	0.080	0.021	0.37	0.097
1,3,5-Trimethylbenzene	0.080	0.026	0.39	0.13
1,3-Butadiene	0.16	0.025	0.35	0.055
1,3-Dichlorobenzene	0.080	0.026	0.48	0.16
1,4-Dichlorobenzene	0.080	0.026	0.48	0.16
1,4-Dioxane	0.20	0.032	0.72	0.12
2,2,4-Trimethylpentane	0.20	0.016	0.93	0.075
2-Butanone (MEK)	0.40	0.080	1.2	0.24
2-Chlorotoluene	0.16	0.025	0.83	0.13
2-Hexanone	0.20	0.023	0.82	0.094
3-Chloropropene	0.080	0.019	0.25	0.059
4-Ethyltoluene	0.16	0.026	0.79	0.13
4-Methyl-2-pentanone (MIBK)	0.20	0.018	0.82	0.074
Acetone	2.0	0.54	4.8	1.3
Benzene	0.080	0.023	0.26	0.073
Benzyl chloride	0.16	0.031	0.83	0.16
Bromodichloromethane	0.080	0.018	0.54	0.12
Bromoform	0.080	0.019	0.83	0.20
Bromomethane	0.080	0.013	0.31	0.050
Carbon disulfide	0.20	0.012	0.62	0.037
Carbon tetrachloride	0.080	0.015	0.50	0.094
Chlorobenzene	0.080	0.020	0.37	0.092
Chloroethane	0.080	0.014	0.21	0.037
Chloroform	0.080	0.015	0.39	0.073
Chloromethane	0.20	0.064	0.41	0.13
cis-1,2-Dichloroethene	0.080	0.024	0.32	0.095
cis-1,3-Dichloropropene	0.080	0.029	0.36	0.13
Cyclohexane	0.20	0.016	0.69	0.055
Dibromochloromethane	0.080	0.017	0.68	0.14
Dichlorodifluoromethane	0.080	0.027	0.40	0.13
Ethanol	0.80	0.80	1.5	1.5
Ethylbenzene	0.080	0.027	0.35	0.12
Heptane	0.20	0.019	0.82	0.078
Hexachlorobutadiene	0.40	0.049	4.3	0.52
Hexane	0.20	0.013	0.70	0.046
Isopropyl alcohol	0.80	0.094	2.0	0.23
Methyl tert-butyl ether	0.40	0.068	1.4	0.25
Methylene Chloride	0.20	0.13	0.69	0.45
m-Xylene & p-Xylene	0.080	0.053	0.35	0.23
Naphthalene	0.20	0.040	1.0	0.21
o-Xylene	0.080	0.024	0.35	0.10
Styrene	0.080	0.023	0.34	0.098
tert-Butyl alcohol	0.80	0.015	2.4	0.045
Tetrachloroethene	0.080	0.016	0.54	0.11
Toluene	0.12	0.12	0.45	0.45
trans-1,2-Dichloroethene	0.080	0.020	0.32	0.079
trans-1,3-Dichloropropene	0.080	0.019	0.36	0.086
Trichloroethene	0.040	0.014	0.21	0.075
Trichlorofluoromethane	0.080	0.0098	0.45	0.055
Vinyl bromide	0.080	0.014	0.35	0.061
Vinyl chloride	0.080	0.029	0.20	0.074

NOTES:
ppb - parts per billion
ug/m3 - micrograms per cubic meter

Appendix A

TestAmerica Laboratories, Inc. Quality Assurance Manual

Cover Page:

Quality Assurance Manual

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Quality Assurance Manual
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REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CA-L-S-001	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-L-P-001	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-007	Controlled Purchases Policy
CW-F-S-018	Vendor Selection
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual

REFERENCED LABORATORY SOPs

SOP Reference	Title
CT-QAS-3	SOP for Document Control (Sec. 3.4.1)
CT-MKS-7	Complaint Resolution (Sec .10.1)
QAF00810 QAW01200/1300/1400 QAW1700 QAW01500 QAW01600	SOP Listing (Sec. 13.2) PT Tracking Equipment Table Master Certification Spreadsheet Personnel & Qualifications
CT-RPS-7	LIMS Final Reporting (Sec. 14.1.4)
CT-QAS-16	SOP for Employee Training (Sec. 17.3)
CT-QAS-8	Generating SOPs (Sec. 19.2)
CT-QAS-27	Demonstration of Capability (Sec. 19.4.2)
CT-QAS-17	Conducting MDL Studies (Sec. 19.7)
CT-SMS-11	SOP for Compositing, Homogenization and Subsampling Environmental Samples (Sec. 22.5)
CT-SMS-4	Sample Processing at Sample Arrival (Sec. 23.2.1.3)

SECTION 3

INTRODUCTION *(NELAC 5.1 - 5.3)*

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Connecticut's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with the 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards and ISO/IEC Guide 17025 (1999). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan(CQMP) and the various accreditation and certification programs listed in Appendix 3. The relevant NELAC section is included in the heading of each QAM section.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- EPA SW-846, *Test Methods for the Evaluation of Solid Waste, 3rd Edition,* September 1986; Update I, July 1992; Update II, September 1994; and Update III, December 1996.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- USEPA Contract Laboratory Program. *Statement of Work for Inorganics Analysis. Multi-Media, Multi-Concentration.* Document ILM04.0.
- USEPA Contract Laboratory Program. *Statement of Work for Organics Analysis. Multi-Media, Multi-Concentration.* Document Number OLMO3.1, August 1994, OLM04.2.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th and 21st Edition.
- Nuclear Regulatory Commission (NRC) quality assurance requirements.

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 4 of the QAM. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director/Manager and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director/Manager and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

This manual is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (refer to SOP No. CT-QAS-3).

SECTION 4

ORGANIZATION AND MANAGEMENT *(NELAC 5.4.1)*

4.1 OVERVIEW

TestAmerica Connecticut is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. TestAmerica Connecticut has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Operating Officer, Corporate Quality Assurance, etc.). The TestAmerica Connecticut laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Connecticut is presented in Figure 4-1.

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Quality Assurance Program

The responsibility for quality lies with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Connecticut laboratory.

4.2.2 General Manager (GM)

Each GM reports directly to a COO. Each GM has full responsibility for the overall administrative and operational management of their respective laboratories. The GM's responsibilities include allocation of personnel and resources, long-term planning, setting goals, and achieving the financial, business, and quality objectives of TestAmerica. The GM ensures timely compliance with corporate management directives, policies, and management systems reviews. The GM is also responsible for restricting any laboratory from performing analyses that cannot be consistently and successfully performed to meet the standards set forth in this manual.

4.2.3 Laboratory Director

TestAmerica Connecticut's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical directors for the appropriate fields of testing. The name(s) of the Technical Director will be included in the national database. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, CSM and the Technical Director(s), as direct reports.

4.2.4 Quality Assurance (QA) Manager

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.

The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.

- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 13.
- Monitoring standards of performance in quality control and quality assurance.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Captains the QA team to enable communication and to distribute duties and responsibilities.

4.2.5 Supervisors

Supervisors (Technical Directors) report to the Laboratory Director. Each one is responsible to:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training (as documented in Section 8.1), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.

- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the Technical Director, Operations Manager, and/or QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his department.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Report all non-conformance conditions to the QA Manager and Laboratory Director.
- Ensure that preventive maintenance is performed on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.
- Develop, implement, and enhance calibration programs.
- Provide written responses to external and internal audit issues.

4.2.6 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Director, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.

- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.7 Environmental Health and Safety Officer

The Safety Officer reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is “reasonable” and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica’s medical consultants.

4.2.8 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.

4.2.9 Client Service Manager

The Client Service Manager reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

4.2.10 Project Manager

The Project Manager reports directly to the Division Manager and serves as liaison between the laboratory and its clients. The Project Manager's responsibilities include:

- Ensure client specifications are met by communicating project and quality assurance requirements to the laboratory. Ensure client specific reporting and quality control requirements are met.
- Notify laboratory personnel of incoming projects and sample delivery schedules.
- Monitor the status of all projects in-house to ensure timely delivery of reports.
- Inform clients of project-related problems, resolving service issues and coordinating technical issues with the laboratory staff.
- Coordinate client requests for sample containers and other services.
- Schedule sample pick-ups from client offices or project sites and notifying the laboratory staff of incoming samples.
- Coordinate subcontract work.
- Assist clients in procuring the proper sampling supplies.
- Respond to client inquiries concerning sample status.
- Assist clients with resolution of problems concerning Chains-of-Custody.

- Prepare laboratory quotes and project bids.
- Review sample log-in sheets, when there is a question regarding a Chain of Custody issue.

4.2.11 Sample Custodian

The Sample Custodian reports to the Project Management Department. The responsibilities of the Sample Manager are outlined below:

- Direct the logging of incoming samples into the LIMS.
- Insure timely and correct shipment of sample containers to clients. Maintain accurate records of sample container shipments.

- Perform sample collection and sample pick-up
- Ensures sample containers are prepared for sampling
- Performs field tests and measurements and operates and maintains equipment used for those purposes.

4.3 DEPUTIES

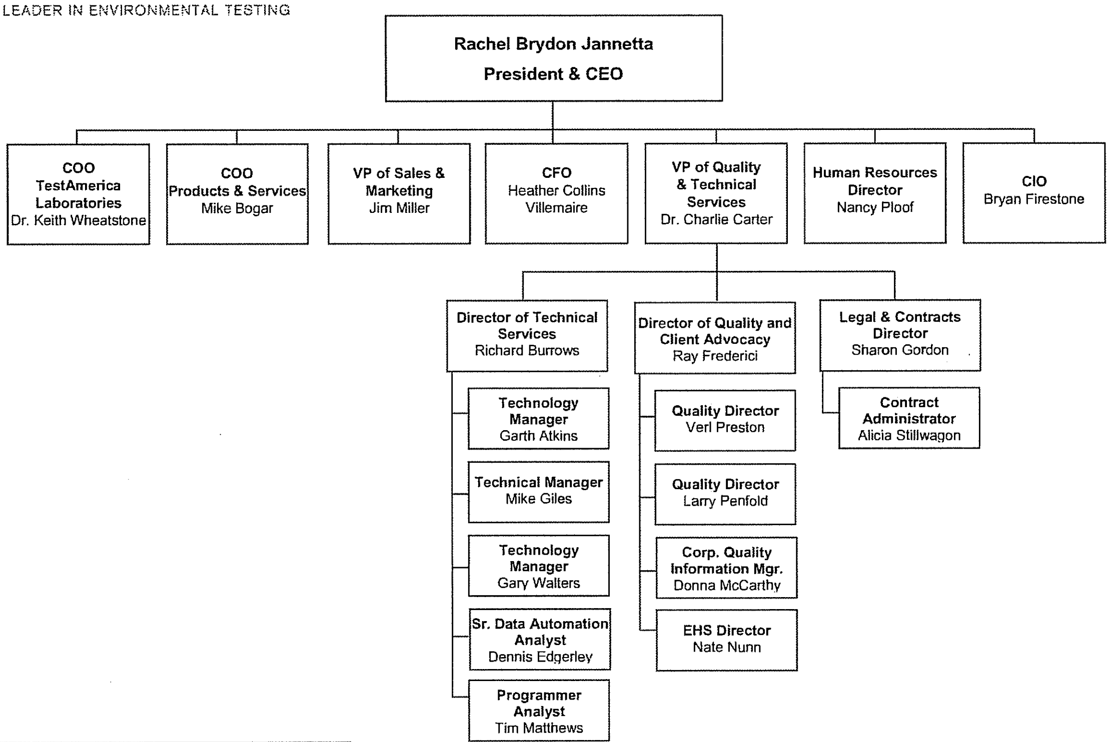
The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director Larry Decker	Paul Hobart	
QA Manager Dawn May	Patty Mercure	
Organic Technical Director Kim Maturo	Magdalena Szymczuk	
Metals Technical Director Nestor Petronchak	Joseph Voytek	
Wet Chemistry Technical Director Doreen Nemeth	David Madumadu	
EHS Coordinator Daniel Helfrich	Joseph Voytek	

Figure 4-1.

Corporate and Laboratory Organization Charts

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING



Note: QA Managers and Safety Coordinators in all laboratories and facilities have a dotted line reporting relationship to Corporate QA and EHS.

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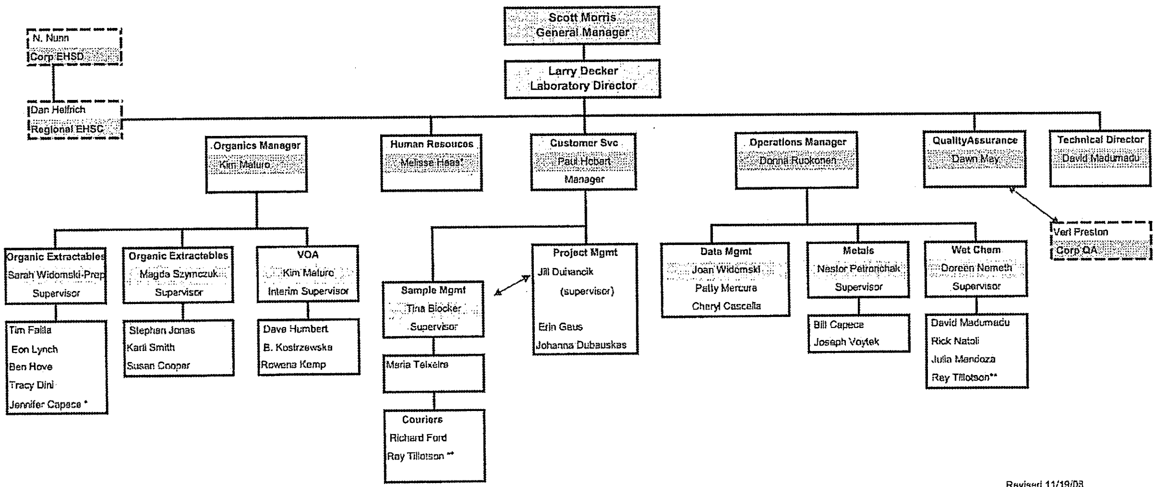
TestAmerica Connecticut Organization



* Part-timers
** Split Role

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SECTION 5

QUALITY SYSTEM *(NELAC 5.4.2)*

5.1 QUALITY POLICY STATEMENT

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CA-L-P-001) and Employee Ethics Statements.
- ~~An~~ Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CA-L-S-001.)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-L-S-001).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).
- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.

- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Corporate Quality Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Policy Memorandum
- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory's has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's (QAM) shall take precedence over the CQMP in those cases.

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory maintains a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in Section 24.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Supervisor and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory. All control limits are stored within a LIMS Method limit group. These are set up under the control of the QA department. Any time a limit is updted, a historical record with activiation and expiration date is generated for the limit type. Archived limits can be exported to excel at any time by utilizing the "Historical" button in the Method limit group. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate recoveries are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

Control charts are used to establish method performance of a given analysis and to monitor trends of QC results graphically over time. Once a data base of the laboratory results for a method/matrix/QC analyte combination is established, the acceptability of a given analysis of that QC parameter (and of the analytical batch to which it belongs) can be evaluated in light of the laboratory's normal performance. This is intended to help identify problems before they might affect data. Often, patterns of response that are not at all evident in sets of numbers are very distinct when the same values are viewed as a chronological graph.

Establishment of Limits

The purpose of using statistical control limits is to define, for each analyte in a given method/matrix/QC type combination, a range of expected values. This range encompasses the random variation that occurs normally in the laboratory and allows one to evaluate control samples in that context, rather than according to an arbitrary or external set of values. Limits for accuracy and precision are defined below:

Accuracy

As recoveries of a QC analyte in a given matrix are tabulated over time, a mean value for recovery is established, as is the standard deviation (s) of those recoveries. If the analysis is in statistical control (e.g., if the set of QC recoveries over time show random variation about the mean) approximately 99.7% of all recoveries for that QC will fall within three standard deviations (3s) of the mean. Thus, assuming that the mean itself is an acceptable level of recovery, the values corresponding to 3s above and 3s below the mean are defined as the Control Limits. Any single recovery outside these values is assumed to have resulted from some circumstance other than normal variation and shall be investigated.

Roughly 95% of points should fall within 2s of the mean. The values +2s and -2s are the Warning Limits. Any normal result has approximately a 1/20 chance of being between 2s and 3s from the mean, so a result in this region doesn't necessarily warrant corrective action, but attention should be paid to such points.

Precision

Precision is used to indicate matrix variability so that appropriate decisions can be made by the client when repeated analyses vary significantly. The coefficient of variation, expressed as a percentage (e.g., the %RSD) for the data set used to calculate accuracy control limits defines the control limit for precision. Duplicate analyses of the QC samples, such as duplicates or MS/MSD, should have an RPD less than or equal to this established precision control limit to be considered free of matrix interferences.

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL *(NELAC 5.4.3)*

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP No. CT-QAS-3.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a document control system for each document include a unique document title and number, the number of pages of the item, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retains the official document on file. The official document is provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of every two years and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual, refer to SOP on Document Control, SOP No. CT-QAS-3. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in the QA folder for the applicable revision.

For changes to SOPs, refer to SOP No. CT-QAS-008, Standard Operating Procedure for Generating SOPs. The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions and information are organized by department in the QA office. These are tracked by excel spreadsheet. Electronic versions are kept on the laboratory server; hard copies are kept in QA files. The procedure for the care of these documents is in SOP CT-QAS-3, SOP for Document Control.

6.4 OBSOLETE DOCUMENTS

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to the SOP on Document Control SOP No. CT-QAS-3.

SECTION 7

SERVICE TO THE CLIENT *(NELAC 5.4.7)*

7.1 OVERVIEW

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and the laboratory's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these regulatory and client requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the lab's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002, Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below) :

- Legal & Contracts Director
- General Manager
- The Laboratory Client Service Manager
- The Laboratory Operations Manager
- Laboratory and/or Corporate Technical Directors
- Laboratory and/or Corporate Information Technology Managers/Directors
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director/Manager reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Legal Contracts Director, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts. The PM assigned to the project maintains a copy for the lab.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. All relevant information is stored on a designated corporate server in the contracts\Connecticut directory.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote will be filed with the laboratory PM and the Lab Director/Manager.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log in a note book of pertinent conversations with the client. If need be, a follow up email is sent.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during operation or supervisor meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 SPECIAL SERVICES

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Section 15 and 25).

Note: ISO 17025/NELAC 2003 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 CLIENT COMMUNICATION

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Directors are available to discuss any technical questions or concerns that the client may have.

7.6 REPORTING

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service.

TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS *(NELAC 5.4.5)*

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in NELAC/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-NELAC accredited work where required.

Project Managers (PMs), Customer Service Managers (CSM), or Regional Account Executives (RAE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

Note: In addition to the client, some regulating agencies, such as the US Army Corps of Engineers and the USDA, require notification prior to placing such work.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Regional Account Executive (RAE), or Customer Service Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories and supporting documentation is available on the

TestAmerica intranet site. Verify necessary accreditation, where applicable, (e.g., on the subcontractors NELAC, A2LA accreditation or State Certification).

- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- NELAC or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director/Manager. The Laboratory Director/Manager requests that the QA Manager or Operations Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site along with the associate documentation and notify the finance group for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Lab Directors/Managers, QA Managers and Sales Personnel.

8.3 OVERSIGHT AND REPORTING

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM (or RAE or CSM) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on a Subcontracted Sample Form (Figure 8-1) and the form is retained in the project folder. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a Chain of Custody (COC). A copy of the original COC sent by the client must be included with all samples subbed within TestAmerica.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-NELAC accredited work must be identified in the subcontractor's report as appropriate. If NELAC accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs. In the event this provision is utilized, the QA Manager will be required to verify certifications. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

Figure 8-1.
Example - Subcontracting Laboratory Approval Form (Initial / Renewal)

SUBCONTRACTING LABORATORY APPROVAL

Reference: Section 8 – Quality Assurance Manual

Date: ____________________
Laboratory: ____________________
Address: ____________________
____

Contact and e-mail address: ____________________
Phone: Direct ____________________ Fax ____________________

Requested Item[3]	Date Received	Reviewed/ Accepted	Date
1. Copy of State Certification[1]			
2. Insurance Certificate			
3. USDA Soil Permit			
4. Description of Ethics Program[3]			
5. QA Manual[3]			
6. Most Recent (and relevant) 2 Sets of WP/WS Reports with Corrective Action Response[1,3]			
7. State Audit with Corrective Action Response (or NELAC or A2LA Audit)[3]			
8. Sample Report[3]			
9. SOQ or Summary list of Technical Staff and Qualifications [3]			
10. SOPs for Methods to Be Loadshifted[2,3]			
11. For DoD Work: Statement that Lab quality system complies with QSM.			
12. For DoD Work: Approved by specific DoD Component laboratory approval process.			

1 - Required when emergency procedures are implemented.
2 - Some labs may not submit copies due to internal policies. In these cases, a copy of the first page and signature page of the SOP is acceptable. This requirement may also be fulfilled by supplying a table of SOPs with effective dates.
3 – If the laboratory has NELAC accreditation, Item #s 4 through 10 are not required.

On Site Audit Planned: YES NO If yes, Date Completed: ____________ By Whom: ________________

Comments:

Lab Acceptable for Subcontracting Work: YES NO Limitations: ____________________

QA Manager: ____________________ Date: ______________
(Printed Name)

☐ Forwarded to Contract Coordinator, by: ____________________ Date: ______________

SECTION 9

PURCHASING SERVICES AND SUPPLIES *(NELAC 5.4.6)*

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Purchasing guidelines for equipment and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP.

The laboratory utilizes the JD Edwards One World software accessed thru the corporate intranet for materials requisitions. User names and passwords are distributed to authorized personnel. Orders are placed bi-weekly by the users and are approved by the Laboratory Director. Only corporate approved suppliers are allowed to be used.

Orders are reviewed by Corporate and placed to the suppliers.

The analyst may also check the item out of the on-site consignment system that contains items approved for laboratory use.

9.3.2 Receiving

It is the responsibility of the purchasing manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to date the material when received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. Material Safety Data Sheets (MSDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method. Chemicals should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date can not be extended if the dry chemical is discolored or appears otherwise physically degraded, the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical is compared to an unexpired independent source in performing the method and the performance of the dry chemical is found to be satisfactory.

The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained with the QA Manager.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- mmho/cm (or specific resistivity of greater than 1.0 megaohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Department Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased VOA vials must be certified clean and the certificates must be maintained. If uncertified VOA vials are purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Director or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or supervisor makes a supply request to the Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate

Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the IT Department or QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers and Laboratory Director.

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Corporate Finance documents on Vendor Selection (SOP No. CW-F-S-018) and Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Laboratory Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10

COMPLAINTS *(NELAC 5.4.8)*

10.1 OVERVIEW

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following SOP CT-MKS-7. Complaints are documented and tracked utilizing the lims Non-Conformance module. An NCM is generated within the lims system and the complaint is fully documented and connected with the job for which it originated from. At the end of each month, all complaints are compiled using a the Management reports in LIMS and all are listed in the monthly QA report.

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to (SOP# CT-MKS-7).

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelyhood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery

- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11

CONTROL OF NON-CONFORMING WORK *(NELAC 5.4.9)*

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed.

When an analyst encounters such a situation, the problem is presented to the supervisor for resolution. The supervisor may elect to discuss it with the Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Laboratory Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with NELAC (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

11.2 RESPONSIBILITIES AND AUTHORITIES

TestAmerica's Corporate SOP entitled *Internal Investigation of Potential Data Discrepancies and Determination for Data Recall* (SOP No. CA-L-S-001), outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances, the Laboratory Director or QA Manager may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Department Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director/Manager, QA Manager, ECOs, Corporate Quality, the COO, General Managers and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CA-L-S-001) distinguishes between situations when it would be appropriate for laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CA-L-S-001.

11.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc...). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Technical Director, QA Manager, Supervisor) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management, and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION *(NELAC 5.4.10)*

12.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo's (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1 and 12-2).

12.2 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc..

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify Systematic Problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 **Non-Conformance Memo (NCM)** - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints

12.2.2 **Corrective Action Report (CAR)** - is used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and external audit findings.
- Failed or unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors

- Health and Safety violations
-

12.3 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Supervisor, Laboratory Director/Manager, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Monitoring of the Corrective Actions

- The Department Manager/Supervisor and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Department Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is generated through the LIMS system. NCM are tracked and a monthly summary of all corrective actions can be generated and exported to excel for review to aid in esuring that the corrective actions have taken effect.
- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.4 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.2.4, Special Audits.)

12.4 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM or CAR.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs. The laboratory may also maintains Work Instructions on these items that are available upon request.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs, Work Instructions, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented.

12.5 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original "uncorrected" file must be maintained intact and a second "corrected" file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Corrective Action Report

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Corrective Action Report

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Open Date:______________ **Initiated By:**______________

Basis:

- ☐ Audit
- ☐ PT Failure
- ☐ SOP Departure
- ☐ Complaint
- ☐ QC Failure
- ☐ Prevention

Description: ____________________________

Method: ____________________________

Root Cause / Purpose:

Investigated By: **Date:**

Potential Corrective / Preventive Actions:

Recommended By: **Date:**

Corrective Actions Performed:

Performed By: **Date:**

Disposition of Data:

- ☐ Reanalyzed
- ☐ Rejected
- ☐ Qualified
- ☐ Recalled

Follow-Up Activities:

- ☐ Continue with another Corrective Action
- ☐ Change SOP

Assessed By: **Date:**

QA Manager:	Date:	Closed Date: ________

Document number QAF04700.CT

Figure 12-2
Example – Non-Conformance Memo

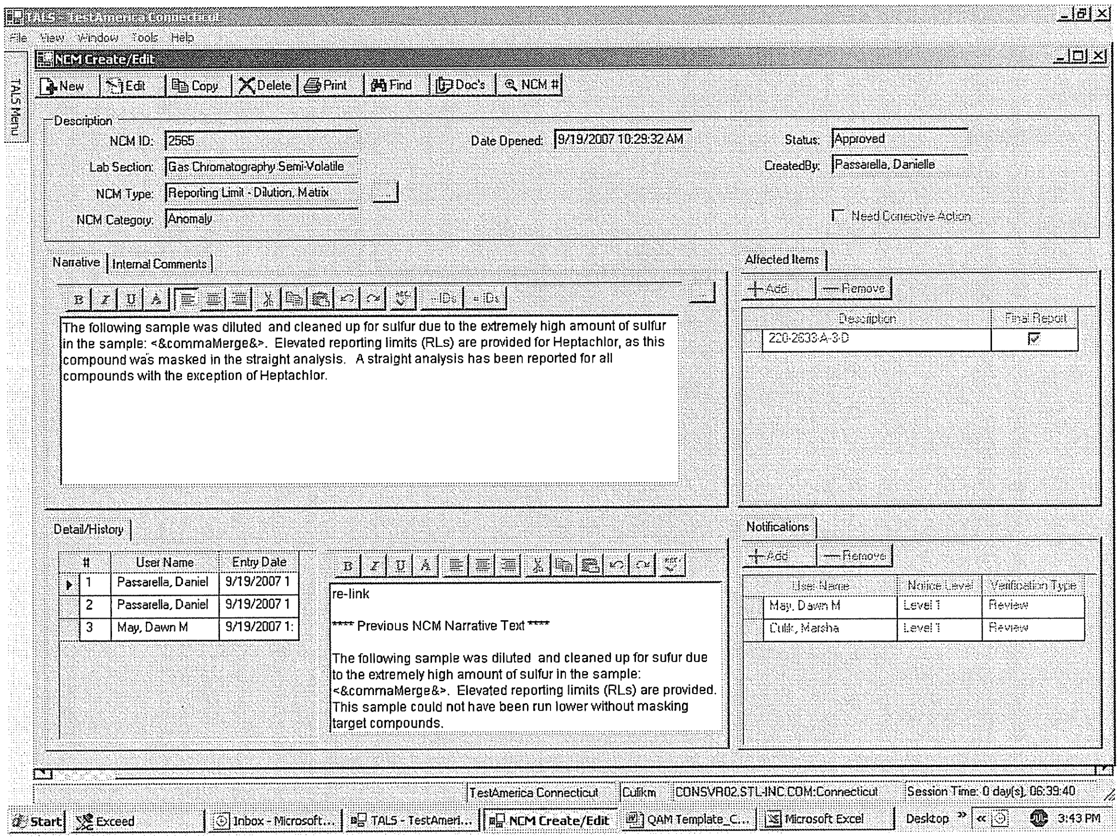


Table 12-1.

Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < ½ RL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Supervisor)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery/%RSD within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and/or recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Supervisor)*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery/ % Difference within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in SOPs/LIMS	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set.
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in SOPs/LIMS.	- Batch must be re-prepared and re-analyzed. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method /Standard Operating Procedures	- Individual sample must be repeated/reextracted. Place comment in LIMS.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Method Blank (MB_ *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results.
Proficiency Testing (PT) Samples *(QA Manager, Department Manager/Supervisor)*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager/ Supervisor, QA Manager, Corporate QA, Corporate Management)	- SOP CA-L-S-001, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CA-L-S-001.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 17 for an example) (QA Manager, Lab Director/Manager, Department Supervisors/Managers)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.

Note:

1. Except as noted below for certain compounds, the method blank should be below the detection limit. Certain programs may require less than ½ the detection limit. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, acetone, 2-butanone and phthalates. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur.

SECTION 13

PREVENTIVE ACTION *(NELAC 5.4.11)*

13.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the QA Metrics Report, internal or external audits, proficiency testing performance, client complaints, staff observation, etc..

The monthly QA Metrics Report shows performance indicators in all areas of the quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used to help evaluate quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Review (Section 16). A highly detailed recap is not required; a simple recount of success and failure within the preventive action program will provide management a measure for evaluation.

13.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these various tracking indicators, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of indicators monitored under this collective system include:

- SOP Tracking
    - Current Revisions w/ Effective Dates
    - Required Biennial Revisions w/ Due Date
- Proficiency Testing (PT) Sample Tracking
    - Pass / Fail – most current 2 out of 3 studies.
- Instrument / Equipment List
    - Current / Location
- Accreditations
    - New / Expiring
- Method Capabilities
    - Current Listing by program (e.g., Potable Water, Soils, etc.)
- Key Personnel
    - Technical Managers, Department Supervisors, etc..

These items are maintained on TestAmerica's Intranet (Proposal Library) or on our internal database (TotalAccess) which uploads to our company internet site.

SECTION 14

CONTROL OF RECORDS *(NELAC 5.4.12)*

The laboratory maintains a record system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA department in a database, which is backed up as part of the regular laboratory backup or archived in banker boxes. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by department supervisors.

Table 14-1. Record Index[1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Respones - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*

	Record Types [1]:	Retention Time:
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits, Disposal Records	7 years
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	7 Years (HR Personnel Files must be maintained indefinitely)
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or an offsite location that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees. Records archived off-site are stored in a secure location. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records are maintained on-site at the laboratory for at least 1 year after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
NY Potable Water NYCRR Part 55-2	10 years

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to Section 19.12.1 for more information. More Information on data archive can be found in the SOP for Data Backup Procedure, CT-SYS-31.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 2 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set. Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as “sampled by,” “prepared by,” “reviewed by”, or “analyzed by”.
- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.
- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory’s ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP CT-RPS-7, Lims final Reporting.
- Also refer to Section 19.13.1 ‘Computer and Electronic Data Related Requirements’.

14.2 TECHNICAL AND ANALYTICAL RECORDS

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code;
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in a specific logbook or on a benchsheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically stored in method parameters associated with each data file, where available.
- analysis type;
- all manual calculations and manual integrations;
- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or

subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;

- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and

- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access.

14.5.4 The laboratory has a record management system (a.k.a. as document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data. Records are considered archived when noted as such in the records management system (a.k.a. as document control).

14.5.5 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.6 Records Disposal

14.5.6.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

14.5.6.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.6.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15

AUDITS *(NELAC 5.4.13)*

15.1 INTERNAL AUDITS

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Audits, SOP No. CA-Q-S-004. The types and frequency of routine internal audits are shown in Table 16-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems	QA Department or Designee	All areas of the laboratory annually
QA Technical Audits - Evaluate raw data versus final reports - Analyst integrity - Data authenticity	QA Department or Designee	All methods within a 2-year period, with at least 15% of methods every quarter
SOP Method Compliance	Technical Director	- All SOPs within a 2-year period - All new analysts or new analyst/methods within 3 months of IDOC
Special	QA Department or Designee	Surveillance or spot checks performed as needed
Performance Testing	Analysts with QA oversight	Two successful per year for each NELAC field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, the laboratory's Data Integrity and Ethics Policies, NELAC quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed. The audit is divided into modules for each operating or support area of the lab, and each module is comprehensive for a given area. The area audits may be done on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, MintMiner is used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Director at least every two years. The work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Nonpotable Water, and Soil.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. A copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2003 NELAC standards.

15.3 AUDIT FINDINGS

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. . A copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS *(NELAC 5.4.14)*

16.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Directors, Operation Manager, their Quality Director as well as the General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Directors, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining quality goals & objectives. Corporate Operations and Corporate QA personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management review (Corporate Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.
- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior lab management meetings. Issues that may be raised from these meetings include:

   - Adequacy of staff, equipment and facility resources.
   - Adequacy of policies and procedures.
   - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/Recall SOP shall be followed (SOP No. CA-L-S-001). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's COO, VP of Client & Technical Services, General Managers and Quality Directors receive a monthly report from the Director of Quality & Client Advocacy summarizing any current data integrity or data recall investigations. The General Manager's are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL *(NELAC 5.5.2)*

17.1 OVERVIEW

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Directors/Department Managers – **<u>General</u>**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Director – **<u>Wet Chem</u>** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 TRAINING

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in the Employee Training SOP (CT-QAS-16).

17.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CA-L-P-001) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS *(NELAC 5.5.3)*

18.1 OVERVIEW

The laboratory is a 14,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may effect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas. The volatile analysis laboratory containing GC/MS instrumentation has a separate air handling system which is maintained at a positive pressure at all times. The organic sample preparation laboratory has a separate HVAC system that creates negative pressure in the area. This design results in a contaminant-free environment for trace level volatile analysis.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 FLOOR PLAN

A floor plan can be found in Appendix 1.

18.5 BUILDING SECURITY

Building keys are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19

TEST METHODS AND METHOD VALIDATION *(NELAC 5.5.4)*

19.1 OVERVIEW

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 STANDARD OPERATING PROCEDURES (SOPS)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002 or the laboratory's SOP entitled 'SOP for Generating SOPS, #CT-QAS-8.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*

- *Statement of Work for Inorganics Analysis, ILM04.1, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Statement of Work for Organics Analysis, OLM04.2, USEPA Contract Laboratory Program, Multi-media, Multi-concentration.*
- *Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, OLMO4.1, USEPA Contract Laboratory Program, September 1998.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (Demonstration of Capability(DOC), Lab SOP # CT-RPS-7) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Technical Director/Department Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements (refer to 19.7.10). Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used

Refer to the Corporate SOP No. CA-Q-S-006 or the laboratory's SOP No. CT-QAS-17 for details on the laboratory's MDL process.

19.8 INSTRUMENT DETECTION LIMITS (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

19.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

19.9.1 Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at approximately 2-3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and 1-4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

19.9.2 When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 times the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption and specific electrode response factors.

19.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 524.2, 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 SAMPLE REANALYSIS GUIDELINES

Because there is a certain level of uncertainty with any analytical measurement, a sample reanalysis may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supercede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Supervisor or Laboratory Director/Manager if unsure.

19.14 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOPs for back-up recovery and archive for each of the servers. The laboratory is currently running the TALS Lims system which is a custom in-house developed LIMS system that has been highly customized to meet the needs of the laboratory. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Microsoft SQL Server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 **Maintain the Database Integrity:** Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use.

19.14.1.2 **Ensure Information Availability:** Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 **Maintain Confidentiality:** Ensure data confidentiality through physical access controls, and encryption of when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, *Acceptable Manual Integration Practices*.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1**%.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample

ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Department Manager and QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are out lined in several SOPs *[e.g. Sample Control,, Project Management]* and work instructions, to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also has a corporate SOP discussing Manual Integrations to ensure the authenticity of the data CA-Q-S-002 as well as information within the analytical method SOPs discussing the reason code documentation. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 The data review process at the laboratory starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Control Supervisor reviews the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information.

19.14.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Approximately 15% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit

- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002). Proper manual integration documentation procedures are referenced in the applicable analytical method SOP's in the Manual integration section.

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required.

Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas to for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation

Demonstration of Capability
Certification Statement

Laboratory Name: TestAmerica Connecticut Date:
Laboratory Address: 128 Long Hill Cross Road
Shelton, CT 06484

Method:_______
Matrix: _______

Analyst Name: _______________

*Analyst Name: _______________

We the undersigned certify that:

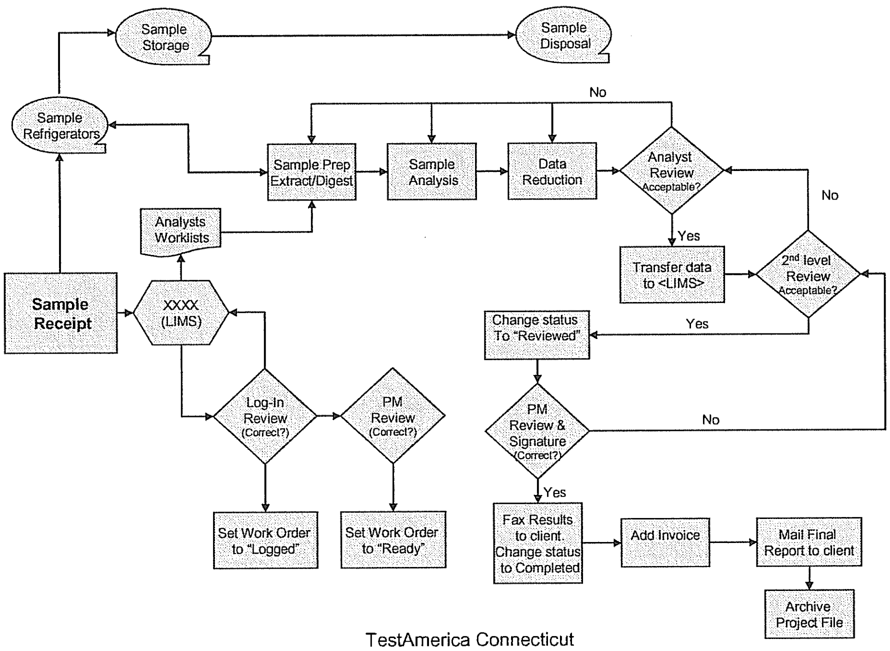
1. The analyst identified above, using the cited test method, which is in use at this facility for the analysis of samples under the National Environmental Laboratory Accreditation Program, have met the Initial Demonstration of Capability.
2. The test method was performed by the analyst identified on this certification.
3. Copies of the test method and SOP are available for all personnel on site.
4. The data associated with the DoC are true, complete and representative.
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is available for review by authorized inspectors.

Laboratory Manager/Supervisor	Signature	Date
Quality Assurance Manager	Signature	Date

* second analyst if sample prepped by another person

Figure 19-2

Example: Work Flow



TestAmerica Connecticut
Workflow

SECTION 20

EQUIPMENT (AND CALIBRATIONS) *(NELAC 5.5.5)*

20.1 OVERVIEW

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturers instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 PREVENTIVE MAINTENANCE

20.2.1 The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed are filed with the Department Manager.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

20.2.7 If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Refer to the SOP for Balance Calibration, CT-QAS-9 .

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to $\pm$ 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, digital probes and thermocouples are calibrated quarterly.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP for Thermometer Calibration, CT-QAS-11.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0°C and ≤ 6 °C.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Glass micro-syringes are considered the same as Class A glassware.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements.

Receivers are filled to the meniscus with distilled water. The water is then decanted off to a calibrated weighing vessel. The weight is recorded and is converted to the proper volume. Calibration verfication procedures can be found in specific method SOPs that use this type of glassware.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12).

Note: Instruments are calibrated initially and as needed after that and at least annually

20.4.1 CALIBRATION STANDARDS

20.4.1.1 Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP.

20.4.1.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

20.4.1.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

20.4.1.4 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.2 Calibration Verification

The calibration relationship established during the initial calibration must be verified at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, Section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models.

Note: The process of calibration verification referred to is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

20.4.2.1 Verification of Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

20.4.2.2 Verification of a Non-Linear Calibration

Calibration verification of a non-linear calibration is performed using the percent drift or percent recovery calculations.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Example: Instrumentation List

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler	Method Performed
ICP	Thermo Jarrell Ash (61P) S/N 464790	61E Trace	1997	Yes	6010B, 200.7
ICP-MS	Agilent S/N JP51202170	7500 Series ICP-MS	2008	Yes	6020, 200.8
Mercury Anälyzer	Perkin Elmer S/N 1398 509550	FIMS100	1999	Yes	7471A, 7470, 245.1
GC/MS Semivolatiles	Agilent (U) S/N US33210086	6890/5973	2004	Yes	8270C, 625, SIM
	Agilent (Z) S/N US52430633	6890/5975	2005	Yes	8270C, 625, SIM
	Agilent (A) S/N US52420834	6890/5975	2006	Yes	8270C, 625, SIM
	Agilent (C) S/N US52430481	6890/5975	2006	Yes	8270C, 625, SIM
GC/MS Volatiles	Agilent (L) S/N 3240A18492	5890/5971	1992	Yes	8260B, 624
	Agilent (O) S/N 3203A41807	5890/5971	1991	Yes	8260B, 624 – waters
	Agilent (N) S/N 3133A37851	5890/5971	1991	Yes	8260B, 624
	Agilent (W) S/N U544621422	6890/5973	2005	Yes	8260B, 624 – soils
	Agilent (Y) S/N U544621422	6890/5973	2005	Yes	8260B, 624
	Agilent (V) S/N U540620567	6890/5973	2004	Yes	8260B, 624
GC Semivolatiles	Agilent (GCX-C/D) S/N CN10832045	7890 - Dual FID	2008	Yes	CTETPH 8015B (DRO)
	Agilent (GC4C/D) S/N 3033A33529	5890II - Dual ECD	1992	Yes	8082
	Agilent (GC7C/D) S/N CN10416081	6890-Dual micro ECD	2004	Yes	8081, 8082, 608
	Agilent (GC8C/D) S/N CN10630046	6890-Dual micro ECD	2006	Yes	8081, 8082, 608
	Agilent (GC9C/D) S/N US00028263	6890-Dual micro ECD	2007	Yes	8081, 8082, 608

Instrument Type	Manufacturer	Model	Purchase Date	Autosampler	Method Performed
	Agilent (GC2C/D) S/N 3033A32099	5890II – FID	1991	Yes	CTETPH 8015B (DRO)
	Agilent (GC3) S/N 3033A32563	5890 - FID	1991	Yes	8015B (DRO)
Ion Chromatograph	Lachat S/N A83000-1476	Quickchem 8000	1999	Yes	300.0, 9056 350.1, 351.2 9012, 335.4, 353.2, 420.2
TOC	Dohrmann S/N 98315003	Phoenix 8000	2004	No	415.2, 9060
	Vario Elementar III S/N 11054049	Vario EL	2005	Yes	415.2, 9060, Lloyd Kahn
TKN Digestion System	Scientific Instruments	AD-4020	1994	No	351.2, 351.3
UV/VIS	Thermo electron	Genesys 10	2006	No	7196A, 365.1 or Equiv.
UV/VIS	Buck Scientific (not in use)	HC 404	2000	No	418.1
PH Meter	Orion Research (not in use)	SA 720	1998	No	9040B, 9045C, 150.1
PH Meter	VWR	8025		No	9040B, 9045C, 150.1
Autotitrator (pH, Alkalinity, Conductance)	Man-Tech (ATZ) S/N MS-0A3-615	PC 1300-475	2003	Yes	9040B, 9045C, 150.1, 2320B, 310.1, 310.2, 2510B, 9050A, 120.1
Dissolved Oxygen Meter	YSI	51A	1994	No	405.1
Turbidimeter	HACH	2100 N	1990	No	180.1
Conductivity	Cole-Parmer	1484-20	1996	No	120.1
Automated Distillation Apparatus	Westco S/N 1028	1075 Easy Dist	2003	No	350.1, 420.2, 9066
COD	HACH	45600	1991	No	410.4
Flash Point Apparatus	ERDCO	RT-00001		No	1020
Midi Distillation Setups	Andrews Galss	110-10-R	1995	No	9012A, 335.1, 335.3
TCLP Spinners	Dayton	3M137B/5K939B	1990	No	1311, 1312
GPC	ABC	Autoprep 1000	1999	Yes	8270, 8081, 8082
Selective Chemistry Analyzer	Thermo electron S/N E1519588	Konelab Aqua 20	2004	Yes	350.1, 351.2, 353.2, 365.2
Solvent Evaporator	Horizon Technology	Speed-Vap III	2004	No	1664A
Colorimeter	Hach	DR/890		No	410.4

Table 20-2. Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear Replace lamps Insert clean drying tube filled with Magnesium Perchlorate Fill reductant bottle with 10% Stannous Chloride	Daily As required Daily Daily
ICP	Check pump tubing Check liquid argon supply Check fluid level in waste container Check torch Check sample spray chamber for debris Clean and align nebulizer Check entrance slit for debris Replace pump tubing	Daily Daily Daily Daily Monthly As required Monthly As required
ICP-MS	Check pump tubing Check liquid argon supply Check fluid level in waste container Check torch Check sample spray chamber for debris Clean and align nebulizer Check entrance slit for debris Replace pump tubing Clean/Replace Sample Cones/Skimmer Cones	Daily Daily Daily Daily Monthly As required Monthly As required As required
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Semi-annually
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Inspect line coils, heating baths and filters Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly
Agilent GC/MS	Clean injection ports Pump oil-level check Pump oil changing Ion source cleaning and filament replacement Replace electron multiplier Change exhaust trap absorbent Inspect and refill the calibration sample vial with PFTBA Vacuum fan grills and filters Change liners and septum Column replacement and conditioning Column cutting and reinstallation	As required Monthly Annually As required As required Every 6 months As required Every 6 months As required As required As required

Instrument	Procedure	Frequency
Gas Chromatograph	Injection port cleaning Septum replacement Check for loose/frayed wires and insulation Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	As required As required As Required As Required As Required As Required
Purge and Trap concentrators/ Archon	Check purge flow Inspect line and valve temperatures Change and condition trap Adjust purge flow Rinse sample lines Bake out trap Replace lines and fittings Check syringe Check reagent water and waste bottles Autocalibrate robotic arm Replace inline filter	Daily Daily As required As required As required After each analysis, extend as needed As required Daily Daily As required As required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used
Deionized/Distilled Water	Daily conductivity check System cleaning Replace cartridge & large mixed bed resins	Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

SECTION 21

MEASUREMENT TRACEABILITY *(NELAC 5.5.6)*

21.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware (including glass microliter syringes that have a certificate of accuracy), quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes are verified at least semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware should be routinely inspected for chips, acid etching or deformity. If the Class A glassware is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the 'true' value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. (Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.)

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained within the departments. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to method specific SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name

- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID (generated by the LIMS system)
- Special Health/Safety warnings if applicable

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include a preparation date, expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22

SAMPLING *(NELAC 5.5.7)*

22.1 OVERVIEW

The laboratory does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

22.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria used by the laboratory are derived from the source documents for the methods and are listed in the lab's SOPs. If method required holding times this info is in the SOPs or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located in the SOP for Compositing, Homogenization and Subsampling Environmental Samples, # CT-SMS-11.

SECTION 23

HANDLING OF SAMPLES *(NELAC 5.5.8)*

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

The samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. Samples are only considered to be received by lab when personnel at the laboratory have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. Airbills from the courier are stored in the log-infolder. Tracking numbesr are entered into the LIMS in the cooler receipt comments field.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC, login will complete the custody seal retain the shipping record with the COC, and initiate an internal COC for laboratory use by analysts and a sample disposal record.

23.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented in the LIMS sample Receipt check list and brought to the immediate attention of the Project Manager and subsequently the Client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Sample Acceptance Policy

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;

- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- all samples submitted for water/solid Volatile Organic analyses must have a Trip Blank submitted at the same time;
- Apparent tampering of cooler and/or samples
- Temperature specifications not met
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined. A copy of the sample acceptance policy is provided to each client prior to shipment of samples.

23.2.1.2 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.2.1.3 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or
- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according to the SOP for Sample Processing at Sample arrival, SOP No. CT-SMS-4.

23.3 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. All unused portions of samples, including empty sample containers(for soils), are returned to the secure sample control area. Empty water containeres are disposed of by the department using the sample.

All samples are kept in the refrigerators for 30 days after invoice prior to disposal. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.4 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. Samples should be received into the lab as outlined in the SOPs for sample receiving.

If samples are received with additional paperwork indicating samples are from foreign sources then the samples must be handled and disposed of accordingly. Foreign source samples must be identified as needing special handling upon disposal by placing a green sticker on the top of the jar lid. Mixed waste radiological samples are identified with an orange sticker.

Foreign soil samples are autoclaved then sent out for incineration by a USDA-approved waste hauler.

23.5 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses. The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

23.6 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP for Sample Disposal: #CT-SMS-14. All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than three months from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1.

Example: Chain of Custody (COC)

(TALS Lims generated)

TestAmerica Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Phone (203) 929-8140 Fax (203) 929-8142

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information	Sampler:	Lab PM: Dubauskas, Johanna	Carrier Tracking No(s):	COC No: 220-744.1
Client Contact: Mr. David Heuer	Phone:	E-Mail: johanna.dubauskas@testamericainc.com		Page: Page 1 of 1
Company: ARCADIS U.S., Inc.				STL Job #:
Address: 101 Fieldcrest Ave Suite 5E	Due Date Requested:	**Analysis Requested**		**Preservation Codes:** A - HCL, B - NaOH, C - Zn Acetate, D - Nitric Acid, E - NaHSO4, F - MeOH, G - Amchlor, H - Ascorbic Acid, I - Ice, J - DI Water, K - EDTA, L - EDA; M - Hexane, N - None, O - AsNaO2, P - Na2O4S, Q - Na2SO3, R - Na2S2SO3, S - H2SO4, T - TSP Dodecahydrate, U - Acetone, V - MCAA, W - ph 4-5, Z - other (specify); Other:
City: Edison	TAT Requested (days):			
State, Zip: NJ, 08817				
Phone:	PO #: NJ000389.0008.00002			
Email: david.heuer@arcadis-us.com	WO #:			
Project Name: Trust Maybrook	Project #: 22000351			
Site: New Jersey	SSOW#:			

Sample Identification	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	Analysis Requested	Total Number of containers	Special Instructions/Note:
				Preservation Code:					

Possible Hazard Identification ☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown* ☐ *Radiological*			*Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)* ☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For ________ Months*		
Deliverable Requested: I, II, III, IV, Other (specify)			Special Instructions/QC Requirements:		
Empty Kit Relinquished by:	Date:		Time:	Method of Shipment:	
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Relinquished by:	Date/Time:	Company	Received by:	Date/Time:	Company
Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:		Cooler Temperature(s) °C and Other Remarks:		

Figure 23-2

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - *Client name, address, phone number and fax number (if available)*
   - *Project name and/or number*
   - *The sample identification*
   - *Date, time and location of sampling*
   - *The collectors name*
   - *The matrix description*
   - *The container description*
   - *The total number of each type of container*
   - *Preservatives used*
   - *Analysis requested*
   - *Requested turnaround time (TAT)*
   - *Any special instructions*
   - *Purchase Order number or billing information (e.g. quote number) if available*
   - *The date and time that each person received or relinquished the sample(s), including their signed name.*
   - ***The date and time of receipt must be recorded between the last person to relinquish the samples and the person who receives the samples in the lab, and they must be exactly the same.***
   - **Information must be legible**

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sampler ID
   - Include preservative used.
   - Use indelible ink
   - **Information must be legible**

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested. See Lab Sampling Guide.

4) Samples must be preserved according to the requirements of the requested analytical method (See Sampling Guide.

5) Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C. **Note:** Samples that are hand delivered to the laboratory immediately after collection may not have had time

to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

- Chemical preservation (pH) will be verified upon receipt with the exception of volatiles and the project manager will be notified immediately if there is a discrepancy. Improperly preserved samples will be adjusted and recorded through a preservative sheet and NCM.

6) Sample Holding Times
   - TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

   - Analyses that are designated as "field" analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for "field" analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. Samples analyzed in the laboratory will be qualified on the final report with an 'H' to indicate holding time exceedance.

7) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

8) Recommendations for packing samples for shipment.

   - Pack samples in Ice rather than "Blue" ice packs.

   - Soil samples should be placed in bubble wrap or bubble bags to help prevent breakage upon shipment. TestAmerica will supply these bags with the bottle order.

   - Water samples would be best if wrapped with bubble-wrap or bubble bags to help prevent breakage upn shipment. TestAmerica will supply these bags with the bottle order.

   - Fill extra cooler space with bubble wrap.

Figure 23-3.

Example: Cooler Receipt Form

TestAmerica - Connecticut
Internal Chain-of-Custody

Trip Blank:

QC: Air: Date Received:____________________

FB: Sample #s:________________________

Soil: Water: Locations:_________________________

Laboratory Sample #	Relinquished by	Accepted by	Date	Time	Reason	Relinquished by	Accepted by	Date	Time

TestAmerica Form# SMF00508.CT

SECTION 24

ASSURING THE QUALITY OF TEST RESULTS *(NELAC 5.5.9)*

24.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 NEGATIVE CONTROLS

Table 24-1. Example – Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Example – Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses. Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

24.4.1.5.1 For methods that have 1-10 target analytes, spike all components.

24.4.1.5.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

24.4.1.5.3 For methods with more than 20 target analytes, spike at least 16 components.

24.4.1.5.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

24.4.1.5.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 SAMPLE MATRIX CONTROLS

Table 24-2. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

24.6.3.4 The maximum acceptable recovery limit will be 150%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. Refer to the SOP for Control Charts, QAS02601.ct.

24.6.4.1 One example: The QA department generates a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Connecticut. This summary includes an effective date, is updated each time new limits are generated and is located with the QA manager. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 21.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 18.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25

REPORTING RESULTS *(NELAC 5.5.10)*

25.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed, reviewed, and signed by the appropriate signatory. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report For Samples) with a "sample results" column header.

25.2.2 Each report cover page printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. Job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.

- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (eg. Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Practical quantitation limits or reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.20 When NELAC accreditation is required, the lab shall certify that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not.

25.2.21 The laboratory includes a cover letter.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., partial report). A complete report must be sent once all of the work has been completed.

25.2.26 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.2.27 <u>REPORTING LEVEL OR REPORT TYPE</u>

The laboratory offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank reported to the laboratory MDL, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. A Level II report is not included, unless specifically requested. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.7.

25.2.28 <u>Electronic Data Deliverables (EDDs)</u>

EDDs are routinely offered as part of TestAmerica's services. TestAmerica Connecticut offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), NJ Haz Site, Standard Excel, Dbase, GISKEY, and EQuis.

EDD specifications are submitted to the IT department by the Data Reporting Department for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.3 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

25.3.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.3.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature.

25.3.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.3.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.4 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP # CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.5 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.5.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-203-929-8140 (or for e-mails: please notify us immediately by e-mail or by phone (1-203-929-8140) and delete this material from any computer).

25.6 FORMAT OF REPORTS

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.7 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the LIMS server, as is the original report. The revised report is stored under the Job Deliverables and identified with a revision number.

When the report is re-issued, a notation of "Revision #" is placed on the cover/signature page of the report *or at the top of the narrative page* with a brief explanation of reason for the re-issue and a reference back to the last final report generated. *For Example*: *Report was revised on 11/3/08 to include toluene in sample NQA1504 per client's request. This final report replaces the final report generated on 10/27/08 at 10:47am.*

25.8 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.8.1 Policy on Data Omissions or Reporting Limit Increases

Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

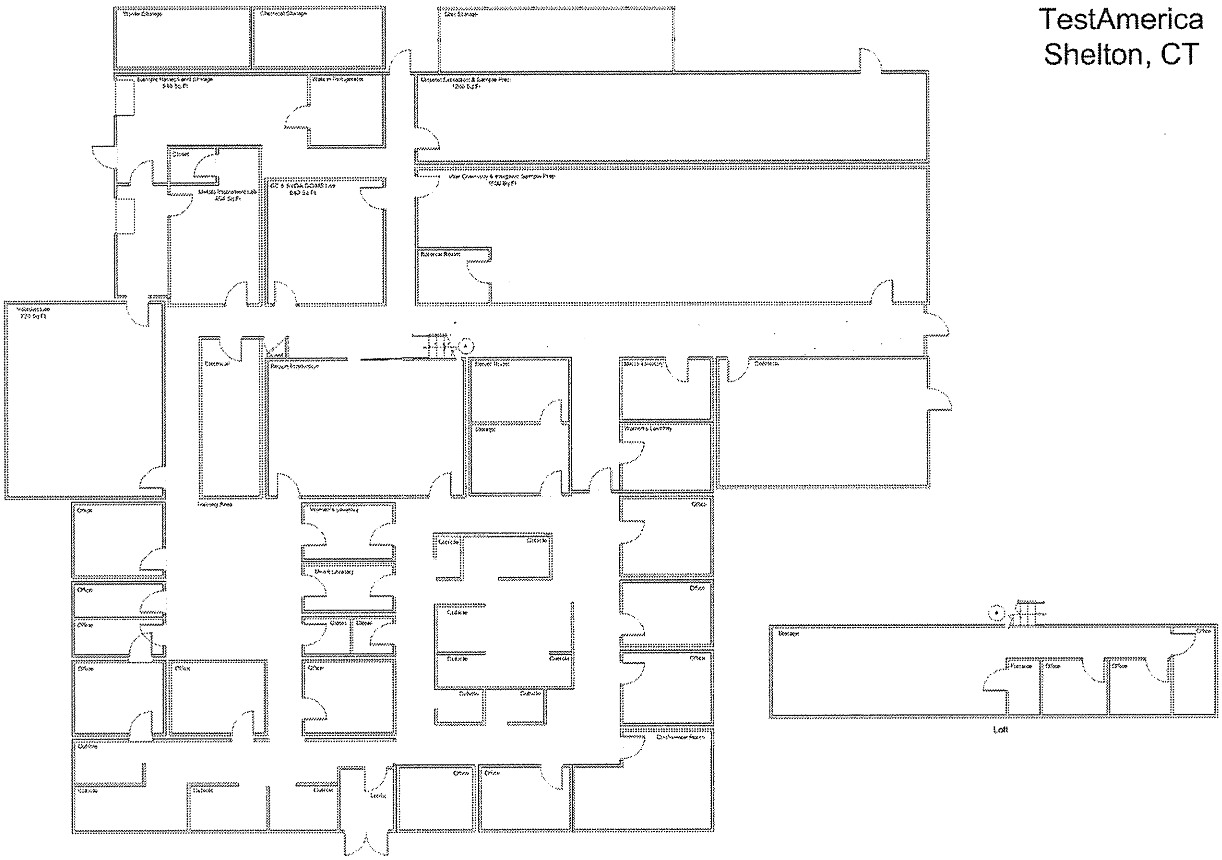
25.8.2 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1.

Laboratory Floor Plan

TestAmerica
Shelton, CT



Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst:
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample:
A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve:
The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures

(NELAC)

Conformance:
An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction: Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis. No significant action is taken to change behavior, process or procedure.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Detection Limit:
The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Internal Standard:
A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:
Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1^{st} Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit.

In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory dependent. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):

Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:
The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Reagent Blank (method reagent blank):
A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Report Limit (RL):
The laboratory nominal Quantitation Limit (QL) or the level of sensitivity required by the client but not lower than the LOD.

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the "cradle-to-grave", including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Toxic Substances Control Act (TSCA):
The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Acronyms:

BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
CRS – Change Request Form
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography

ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

TestAmerica Connecticut maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

State	Responsible Agency	Certification	Lab Number
Connecticut	Department of Health Services	Drinking Water, Wastewater	PH-0497
Maine	Department of Health and Environmental Services	Wastewater/Solid, Hazardous Waste	CT023
Massachusetts	Department of Environmental Protection	Potable/Non-Potable Water	CT023
New Hampshire	Department of Environmental Services	Drinking Water, Wastewater NELAC	2528
New Jersey	Department of Environmental Protection	Drinking Water, Wastewater **NELAC***	CT410
New York	Department of Health	CLP, Drinking Water, Wastewater, Solid/ Hazardous Waste NELAC	10602
Rhode Island	Department of Health	Chemistry...Non- Potable Water and Wastewater	A43
Utah	Department of Health	RCRA-NELAC	2032614458

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, the final report review table, and in the following offices: QA, marketing, and project management.

* Primary Accrediting Authority - NELAC

Appendix 4.

Laboratory Test Methods

Analysis	Method	Analysis	Method
GC/MS Volatiles Prep	5030B	COD	410.4
GC/MS Volatiles Prep	5035H	Total Residual Chlorine	SM4500CL G
GC/MS Volatiles Prep	5035L	Hexavalent Chromium	7196A
GC/MS Volatiles Prep	3585	Trivalent Chromium	SM3500 CR D
GC/MS Volatiles-TCLP	1311ZHE	Color	SM2120B
GC/MS Volatiles	624	Specific Conductance	120.1
GC/MS Volatiles	8260B	Specific Conductance	SM2510B
GC/MS Volatiles	OLM3.2	Cyanide (Amenable)	SM4500 CN G
GC/MS Volatiles	OLM4.3	Cyanide (Total)	335.4
GC/MS Volatiles	524.2	Cyanide (Total & Amenable)	9012B
GC/Svoa Prep - Waters	3510C	Free Cyanide	D4282_02
GC/Svoa Prep - Soils	3550B	CLP Cyanide	ILM4.0
GC/Svoa Prep - Soils	3541	Cyanide Prep – oils/soils	9013
GC/Svoa Prep - Oils	3580A	Ignitability	1030
Florisil Cleanup	3620B	Flashpoint	1020A
Sulfur Cleanup	3660B	Odor	140.1
Acid Cleanup	3665A	Oil & Grease	1664A
GC/Svoa/Metals TCLP Prep	1311	Dissolved Oxygen	SM4500O G
GC/Svoa/Metals SPLP Prep	1312	Nitrogen (Ammonia)	350.1
Pesticides/PCB	608	Nitrogen (Ammonia)	SM4500NH3 B&G
Pesticides	8081A	Total Kjeldahl Nitrogen	351.2
PCB's	8082	Nitrogen – Nitrate/Nitrite	353.2
DRO(Diesel Range Organics)	8015B	Organic Nitrogen	351.2
CTETPH	CTETPH	Paint Filter Liquids test	9095A
GC/MS Svoa	625	Phenolics	420.4
GC/MS Svoa	8270C	Phenolics	9066
Metals Prep – Water	3010A	Phopsphorus	SM4500 PB.5 & E
Metals Prep - Soil	3050B	Orthophosphate	365.3
Metals Analysis	200.7	pH	SM4500H+B
Metals Analysis	200.8	Filterable Residue (TDS)	SM2540C
Metals Analysis	6010B	Non-Filterable Res (TSS)	SM2540B
Metals Analysis	6020	Total Residue (TS)	SM2540B
Mercury - Water	245.1	Total Volatile Residue (TVS)	160.4
Mercury - Water	7470A	Setteable Matter, Residue	SM2540F
Mercury – Soils	7471A	Total Fixed & Vol solids	SM2540G
Hardness	SM2340B	Salinity	SM2520B
Alkalinity	SM2320B	Sulfide	SM4500 S2 E
Anions	300.0	Temperature	SM2550B
Anions	9056	TOC	SM5310C
BOD/CBOD	SM5210B	TOC	9060
		TOC	Lloyd Kahn

Appendix 4.

Laboratory Test Methods

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GC/MS Volatiles	OLM3.2	Cyanide (Amenable)	SM4500 CN G
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Acid Cleanup	3665A	Oil & Grease	1664A
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Metals Analysis	6020	Total Residue (TS)	SM2540B
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Alkalinity	SM2320B	Sulfide	SM4500 S2 E
Anions	300.0	Temperature	SM2550B
Anions	9056	TOC	SM5310C
BOD/CBOD	SM5210B	TOC	9060
		TOC	Lloyd Kahn

Appendix I

Field Sampling Plan (Electronic Only)

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

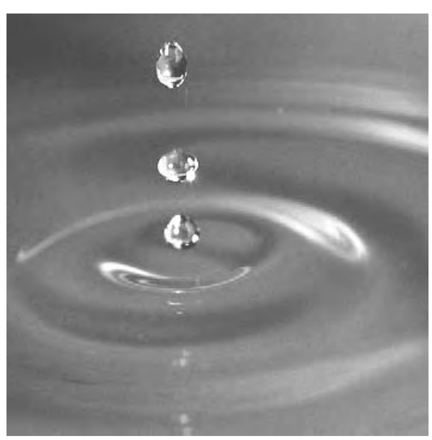
Revised Field Sampling Plan

Skillman Street Former Holder Site

Brooklyn, New York
AOC Index No. A2-0552-0606
Site No. 224068

Submitted to:	**Submitted by:**
National Grid	GEI Consultants, Inc.
287 Maspeth Avenue	455 Winding Brook Drive, Suite 201
Brooklyn, NY 11211	Glastonbury, CT 06033

February 2011
093080-1-1103



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C Chain-of-Custody
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H:\WPROC\Project\KEYSPAN\Skillman Street Holder\SVI Addendum\FSP\Skillman Field Sampling Plan.doc

Abbreviations and Acronyms

ASTM	American Society for Testing and Materials
COC	Chain Of Custody
DNAPL	Dense Non-Aqueous Phase Liquid
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FSP	Field Sampling Plan
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
HVAC	Heating, Ventilating, and Air Conditioning
ID	Identification
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
Lpm	Liter per minute
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquid
NYSDEC	New York State Department of Environmental Conservation
PDA	Personal Data Assistant
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protection Equipment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
SOP	Standard Operating Procedures
VOC	Volatile Organic Compound

1. Purpose

GEI Consultants, Inc. (GEI) has prepared this Field Sampling Plan (FSP) as part of the Site Characterization of the Skillman Street Former Holder Site located in Bedford-Stuyvesant Section of Brooklyn, New York. The FSP was developed as part of the *Skillman Street Former Holder Site Characterization Work Plan* dated July 2007 (Work Plan) that was prepared by GEI. The FSP was revised as part of the *Site Characterization Work Plan* Addendum dated February 2011. This FSP and the Quality Assurance Project Plan (QAPP) were prepared as companion documents to the work plan. The project location is shown on Figure 1 of the Work Plan. Proposed sample locations are summarized in Figure 2 of the Work Plan. The FSP was prepared to provide the applicable procedures for collecting, transporting, and logging analytical samples during the Skillman Street Former Holder Site Characterization.

The QAPP details the project data objectives and quality assurance/quality control (QA/QC) measures that will be implemented during the implementation of the Work Plan.

2. General Field Procedures

2.1 Utility Clearance Procedure

Underground utilities, including electric, telephone, cable television, sewers, water, natural gas, etc., will be identified by owners/operators prior to any intrusive activity. The drilling contractor will place a call to the New York City One Call Center (1-800-272-4480) at least two, but not more than 10 days, prior to the commencement of work activities. The New York City One Call System One Call Center is open 24 hours a day, 7 days a week. The drilling and excavation contractors will make note of ticket reference number and names of the utility operators the notice will be transmitted to. Public and privately owned utilities will be located by responsible agencies at least 48 hours prior to field activities. The contractor will check that each notified operator has either marked the work site or given an "all clear" prior to commencing work. Other potential on-site hazards such as sharp objects, known subsurface structures, overhead power lines, and building hazards will be identified during the site reconnaissance visit.

If intrusive activity occurs on private property, then a private mark out company will be contracted to identify any subsurface utilities or obstructions prior to sample collection. As a precaution, the first 5 feet or 1 foot below the nearest identified utility of the boring location will be cleared utilizing hand tools, vacuum excavation, or non-intrusive methods.

References:

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

2. New York City One Call Center & Long Island internet web page online http://www.nycli1calldsi.com accessed on March 5, 2007.

2.2 Field Notebook Procedure

Objective

The field notebook is intended to serve as a record of significant field activities performed or observed during the project. The field notebook will serve as a factual basis for preparing field observation reports, if required, and reports to clients and regulatory agencies.

Procedure

1. Use a separate all-weather bound notebook for each site/location/project number.

2. Write neatly using black or blue waterproof pen (or note if field conditions [i.e., cold or wet weather] require use of pencil).

3. Write the project name, project number, and book number (i.e., 1 of 3) on the front cover. On the inside cover, identify the project name, project number, and "Return Book To:" the office address of the project manager.

4. Number all of the pages of the field book starting with the first entry.

5. Record activities as they occur.

6. Neatly cross out mistakes using a single line and initial them. Erasures are not permitted. If an error is made on an accountable document assigned to one individual, that individual will make all corrections. The person who made the entry will correct any subsequent error discovered on an accountable document. All subsequent corrections will be initialed and dated.

7. Sign or initial and date the bottom of every page with an entry. Cross out unused portions of a page.

8. Record the following information upon each arrival at the site:

    a. Date/time/weather/project number
    b. GEI personnel
    c. Purpose of visit/daily objectives

9. Record conversations with: [Recommendation - If possible, record telephone numbers of individual contacts for the site in the field notebook.]

    a. Contractors
    b. Clients
    c. Visitors (include complete names, titles, and affiliations whenever possible).
    d. GEI office staff
    e. Landowners (site or abutters)
    f. Note time of arrival and departure of individuals visiting the site.

10. Examples of the field information to be recorded include time of occurrences.

    a. General site work activities
    b. Subcontractor progress
    c. Type and quantity of monitoring well construction materials used
    d. Use of field data sheets or electronic logging equipment (i.e., boring logs, monitoring well sampling logs, etc.)
    e. Ambient air monitoring data
    f. Locations and descriptions of sampling points
    g. Sample media (soil, sediment, groundwater, etc.)
    h. Sample collection method
    i. Number and volume of sample(s) collected and sample bottle preservatives used
    j. Sample identification number (s) and date and time of sample collection
    k. Approximate volume of groundwater removed before sampling
    l. Field observations
    m. Any field observations made such as pH, temperature, turbidity, conductivity, water level, etc.
    n. References for all maps and photographs of the sampling site(s)
    o. Information pertaining to sample documentation such as: bottle lot numbers/ Dates and method of sample shipments/chain-of custody record numbers and overnight shipping air bill numbers.
    p. Surveying data (including sketches with north arrows)
    q. Changes in weather
    r. Rationale for critical field decisions
    s. Recommendations made to the client representative and GEI Project Manager
    t.

11. Record the following information upon departure.

    a. Include a site sketch or representative site photograph of conditions at the end of the day, if required.
    b. Time
    c. Summarize work completed/work remaining
    d. Place a diagonal line though and sign portions of pages not used or skipped.

Precautions

- Only record facts
- Do not fail to record an observation because it does not appear to be relevant at that time.

- Identify conditions or events that could affect/impede your ability to observe conditions.
- Do not use spiral notebooks because pages can be easily removed.

References

1. *ASFE Model Daily Field Report* (1991), ASFE, Inc.

2. GEI Consultants, Inc. Standard Operating Procedure (SOP) No. RE-001 [Field Note Book] February 6, 1995.

3. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

2.3 Daily Activity Report Procedure

Objective

A daily activity report will be generated daily from the field database or field notebook to summarize the activities, observations, and decisions made during the day's fieldwork.

Procedure

At the completion of the day's fieldwork, all pertinent field observations will be recorded in the site database, computer electronic form or on a hard copy paper form. If the electronic database is used, the database will generate the daily activity report that includes all samples collected and submitted to the laboratory for analysis. A daily activity report form is located in Appendix A. This report must be completed at the end of the workday. The daily activity report will be forwarded to the project manager (PM) and site manager once completed. Field reports will be maintained at the site electronically and/or in hard copy form.

Contents of the report should include, at a minimum, the following information:

1. Date, project name, project number/phase/task, and site location.

2. A record of person(s) present at the site during the workday.

3. A brief description of the daily activities performed (e.g., drilled five borings in the overburden).

4. A summary of any significant field observations to include:

   a. A summary of deviation(s) from the work plan or objectives.
   b. A summary of field decision(s) made, who made it/them, and the basis for such decision(s).
   c. Any recommendations that may result from field observations and any actions that resulted from those recommendations.

5. A summary of specific field work completed (e.g. SSMW-01, drilled depth 20 feet).

6. A summary of samples submitted for laboratory analysis.

Precautions:

- The daily activity report should be based solely upon factual information. Any speculation should be clearly noted in the report as such.

- The daily activity report should never be released to anyone other than the project manager (PM) or client unless explicitly authorized by the PM or client.

References

1. GEI Consultants, Inc. Standard Operating Procedure (SOP) No. RE-002 [Field Observation Report] February 6, 1995

2.4 Field Boring Data Logging

Objective

To prepare and record a succinct, accurate representation of subsurface conditions, drilling and soil sampling activities, monitoring well installation details, and borehole abandonment procedures. A completed boring log should contain sufficient information to facilitate the preparation of geologic cross sections, to identify possible contaminant sources or pathways observed, and to offer readers a thorough account of drilling and borehole abandonment procedures.

Procedures

1. All borings will be recorded in a field notebook and/or electronically on a personal data assistant (PDA) in utilizing pLog™ or similar soil logging program. Prior to beginning drilling activities, generic project header information, project staff, subcontractors, and anticipated geologic formations should be entered into the pLog™ database and downloaded to the PDA. If a field notebook is used, then logging will be completed in accordance with procedures described above in subsection 2.2.

2. Complete the log concurrently with drilling procedures (i.e., do not let the driller work faster than your ability to accurately represent the subsurface conditions).

3. If applicable, record the conventional geotechnical parameters during Standard Penetration Testing as per American Society for Testing and Materials (ASTM)-D1586, including blow counts of the hammer per 6-inch increment, total penetration of the split-spoon sampler, and length of the entire sample recovered. Record the weight of the hammer, size of the split-spoon sampler, and distance of the hammer fall.

4. Record the depth at which casing, augers, or drilling equipment are seated and the sizes of the equipment. Be certain to include sizes and seating depths of telescoped casing (if used).

5. Record the time at which each sample is retrieved from the borehole.

6. Record the results of any headspace tests performed on samples collected from discrete depths and also the type of field equipment used.

7. Provide soil descriptions in accordance with soil description procedures located below in Section 4.

8. Use the field book to record any relevant drilling observations that cannot be recorded on the PDA such as advance rate, water levels, drilling difficulties, changes in drilling method or equipment, amounts and types of any drilling fluids, running sands, and borehole stability.

9. Record the procedures and material used to abandon or seal each borehole upon completion.

10. At the completion of the day's activities, download the PDA to the database and generate, review, and edit (if necessary) the completed boring log. If a field notebook is used, make photocopies of the field notebook at the end of each day.

Precautions

- Electronic files should be backed up daily to prevent loss of data. A hardcopy of the boring logs for work performed each day should be generated as a backup. Hardcopy documents should be backed up also.

- Keep boring logs and rock core logs focused on actual observations. Record only factual information on the logs.

3. Subsurface Soil Sample Collection Procedure

The following subsurface soil sample collection procedure is applicable to the collection of representative subsurface soil using direct push GeoProbe® drilling methods. Conventional hollow-stem auger, or resonant sonic drilling technologies may also be used if drilling conditions warrant. Alternative methods may be used at the GEI field representative's discretion with the authorization of National Grid and NYSDEC.

3.1 Sampling Methods

Location, equipment, and sampling situations will dictate the applicable method of sample collection for each boring location. Borings will generally be accomplished through the use of one of the following samplers or techniques:

- GeoProbe® Drilling Techniques
- Conventional Hollow-Stem Auger Drilling Methods
- Resonant Sonic Drilling Methods

These samplers and sampling techniques will result in the collection of representative samples.

3.2 Sample Interferences

Proper sampling procedures will be used to collect samples in accordance with this SOP to prevent cross contamination and improper sample collection. Common causes of sample interferences are listed below to ensure that the samplers can avoid potential sample collection problems.

1. Cross Contamination: Eliminated or minimized through the use of dedicated or disposable sampling equipment where appropriate. Where the use of dedicated or disposable sampling equipment is not possible or practical, the equipment will be decontaminated in accordance with the SOP for Decontamination of Field Sampling Equipment is located in Section 8.

2. Improper Sample Collection: Typical improper sample collection techniques include:

    - Improper decontamination of sampling equipment
    - Use of sampling equipment or sample containers that are not compatible with the contaminants of concern or the laboratory analytical method.
    - Sample collection in an obviously disturbed or non-representative area.

3.3 Equipment/Apparatus

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- GeoProbe® Sampling Apparatus
- Rotary Hollow-Stem Auger Sampling Apparatus
- Rotosonic Sampling Apparatus
- Stainless Steel Sampling Tools
- Laboratory Provided Sample bottles
- Resealable plastic bags
- Ice
- Coolers, packing material
- Chain of Custody records, custody seals
- Decontamination equipment/supplies
- Maps/plot plan
- Safety equipment
- Tape measure
- Digital Camera
- Field data sheets/Logbook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal protection equipment (PPE)

3.4 Subsurface Soil Sample Procedure

Subsurface sampling will be conducted in accordance with the following general procedures and specific guidance for the methods discussed below.

3.4.1 General Procedures

Prior to sampling, New York City One Call will be contacted and an accurate utility mark out will be established as described in subsection 2.1. If drilling on private property, then a private mark out company may be contracted to identify any subsurface utilities or obstructions prior to sample collection.

At each location, plastic sheet, plywood sheet, or other suitable cover will be placed around the augers during conventional hollow stem auger drilling rig to contain soil cuttings.

Procedures for geologic logging, sample collection, and field classification are presented in Section 4.

If a boring exhibits the presence of non-aqueous phase liquid (NAPL), drilling will proceed until signs of the free and residual product are no longer visible in accordance with the work plan and the limitations of the drilling equipment. Any deep drilling through nearby impacted zones will ensure that there is no vertical communication caused by the drilling. Specifically, the upper impacted units may be cased and grouted into a lower, more confining unit, if encountered.

All the borings will be backfilled using a tremie pipe from the bottom to the top of the bore hole with cement/bentonite grout in accordance with NYSDEC guidelines for standard grout mixtures:

- One 94-pound bag Type I Portland cement
- 3.9 pounds powdered bentonite
- 7.8 gallons potable water

The boring will be grouted to the surface and allowed to cure overnight. If excessive settling is observed in the borehole due to seepage of the grout into the formation, then additional grout may be applied. The surface conditions including any asphalt/concrete surface will then be restored to its original condition.

Investigation derived wastes will be handled as specified in investigation-derived waste handling procedure located in Section 10.

3.4.2 Direct Push GeoProbe® Procedures

For direct push GeoProbe® methods, discrete soil samples will be collected from each boring using a 4-foot or 5-foot close piston Macro-Core® sampler configuration. Macro-Core® will be advanced to the beginning of the intended sample interval, the piston will be released and the Marco-Cores® will be driven to the end the intended sample interval. This method will ensure that sampling of “slough” does not occur. The Macro-Core® will then be retrieved and the collected soil core will be extruded from the sampler along with the liner. After decontamination, the Macro-Core® sampler will be re-assembled using a new liner. The Macro-Core®, rods and other sample collection equipment will decontaminated as indicated below in subsection 8.2.2. Direct push GeoProbe® methods have been selected for site characterization activities.

3.4.3 Rotary Hollow Stem Auger Procedures

For rotary hollow-stem auger methods, split-spoon sampling will be conducted in accordance with ASTM Specification D-1586-84 for standard penetration test and split barrel sampling. Soil samples will be collected continuously through split-spoon sampling methods at the boring location. Split spoon samples will be collected ahead of the lead auger flight. Upon collection of each split spoon sample, the lead auger will be advanced over the sampled interval prior to collection of the next split spoon sample. This method will ensure that "double-spooning" ahead of the augers does not occur. In addition, while the augers are being advanced a temporary auger plug will be placed at the bottom of the lead auger to minimize or eliminate the potential for formation materials to run up into the augers. The use of an auger plug will help assure that split spoon samples are representative of in-situ formation materials. Split-spoons will be decontaminated after each sample is collected as indicated below in Subsection 8.2.2.

3.4.4 Rotosonic Procedures

For rotosonic methods, soil samples will be collected utilizing a stainless steel core barrel that is advanced utilizing resonant sonic energy. A larger diameter casing is then advanced over the core barrel. The core barrel is retrieved to the surface for sample extrusion. Core samples will be taken directly from the core barrel by extruding it into a plastic baggie-like sleeve, stainless steel tray, or retained in a clear plastic liner. The core barrel will be cleaned with tap water following each use. The field geologist will classify and sample the soil located within the liner. Upon completion, the excess soil will be placed into a 55-gallon drum for disposal and the inner liner properly disposed as indicated in Section 10. The core barrel will then be advanced within the isolation casing on the same borehole to collect the next soil core interval. The core barrel, casing, and other sample collection equipment will decontaminated as indicated below in subsection 8.2.2.

References

New York State Department of Environmental Conservation, Division of Environmental Remediation, 2003. *Groundwater Monitoring Well Decommissioning Procedures*. NYSDEC, April, 2003.

ASTM, 1997. *D1586-84 (1992) Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils.* ASTM, West Conshohocken, PA. 1997.

4. Soil Description Procedure

The following soil description procedure is applicable for use in describing subsurface soils. This procedure may be varied or changed as required, dependent upon site conditions and equipment limitations. Any deviation from this standard will be documented in the field sampling book and in the final report.

4.1 Description Method

All soils will be described using the Unified Soil Classification System/ASTM D2488. The use of one standard will allow continuity of sampling descriptions between sample locations and personnel.

4.2 Sample Interferences

Proper handling of cores while recording descriptions will be used to ensure that handling does not affect sample collection or cause cross contamination within the core sample.

Cross Contamination: Eliminated or minimized with dedicated or disposable sampling equipment where appropriate. Where the use of dedicated or disposable sampling equipment is not possible or practical, the equipment will be decontaminated in accordance with the procedure for the decontamination of field sampling equipment located below in Section 8.

4.3 Equipment/Apparatus

Equipment needed for description of soil and sediment samples may include:

- Stainless steel sampling tools
- Decontamination equipment/supplies
- Safety equipment
- Tape measure
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent marker
- Personal protection equipment (PPE)

4.4 Soil Sample Description Procedure

The sampling procedure is as follows:

All soils are to be logged using ASTM D2488 *Standard Practice for Description and Identification of Soils*. The description of each sample interval should be prepared as follows:

1. The specific intervals for description should be noted for each sample. The description should not necessarily be for the entire subsurface soil interval. Geologic horizons, small-scale units, or other changes in soil conditions within the subsurface soil sample should be identified and described separately.

2. Soil description should include particular notes if the field representative believes that there is a possibility the soil sample being described is not representative of the interval sampled.

3. The following data will be recorded on the sample collection method, if applicable:

    a. Method of collection, hollow stem auger, rotosonic, GeoProbe®, etc.
    b. Interval sampled vs. amount recovered.
    c. Blow counts, weight of hammer, and hammer free fall distance for split spoon samplers, if used.

4. For course grained soils with less than 50% fines:

    a. GROUP NAME (SYMBOL), Structure, % Gravel Sand and Fines in order of predominance, % Cobbles and/or boulders (by Volume), Maximum Particle Size, Other (moisture, depositional descriptions, representativeness), Color, Local or Geologic Name, environmental/geologic descriptions.

5. For fine grained soils with greater than or equal to 50% fines:

    a. GROUP NAME (SYMBOL), Structure, Plasticity, Plasticity characteristics (if performed), % Gravel Sand and size ranges, Other (moisture, depositional descriptions, representative nature), Color, Local or Geologic Name, Field Soil Strength measurements (if performed), environmental/geologic descriptions.

6. Specific descriptions of each of the above description categories are described in Appendix B and on the next couple of pages.

7. Soil moisture will be described as Dry, Moist, or Wet.

8. Soil color will be described using the color chart in Appendix B. Colors may be combined: e.g., red-brown. Color terms should be used to describe the "natural color" of the sample as opposed to staining caused by contamination.

9. The representative nature of the sample interval should be noted if there is a possibility the soil sample being described is not representative of the interval sampled.

10. Visual evidence of contamination should be described in the sample log with the specific depths or depth intervals where the contamination was noted. Descriptions of visual, olfactory, and product observed should conform to the following standards.

    a. **Sheen** - iridescent petroleum-like sheen. Not to be used to describe a "bacterial sheen" which can be distinguished by its tendency to break up on the water surface at angles whereas petroleum sheen will be continuous and will not break up. A field test for sheen is to put a soil sample in a jar of water and shake the sample (jar shake test), then observe the presence/absence of sheen on the surface of the water in the jar.

    b. **Stained** - used w/color (i.e., black or brown stained) to indicate that the soil matrix is stained a color other than the natural (non-impacted) color of the soil.

    c. **Coated** - soil grains are coated with tar/free product – there is not sufficient free-phase material present to saturate the pore spaces.

    d. **Blebs** - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically, this is residual product.

    e. **Saturated** - the entirety of the pore space for a sample is saturated with the tar/free product. Care should be taken to ensure that you are not observing water saturating the pore spaces if you use this term. Depending on viscosity, tar/free-phase saturated materials may freely drain from a soil sample.

    f. **Oil**. Used to characterize free and/or residual product that exhibits a distinct fuel oil or diesel fuel like odor; distinctly different from Manufactured Gas Plant (MGP)-related odors/impacts.

g. **Tar**. Used to describe free and/or residual product that exhibits a distinct "coal tar" type odor (e.g., naphthalene-like odor). Colors of product can be brown, black, reddish-brown, or gold.

h. **Solid Tar**. Used to describe product that is solid or semi-solid phase. The magnitude of the observed solid tar should be described (e.g. discrete granules or a solid layer).

i. **Purifier Material**. Purifier material is commonly brown/rust or blue/green wood chips or granular material. It is typically associated with a distinctive sulfur-like odor. Other colors may be present.

j. **Olfactory Descriptors.** Use terms such as " tar-like odor" or "naphthalene-like odor" or "fuel oil-like odor" that provide a qualitative description (opinion) as to the possible source of the odor. Use modifiers such as strong, moderate, faint to indicate intensity of the observed odor.

k. **Dense Non-Aqueous Phase Liquid (DNAPL)/Light Non-Aqueous Phase Liquid (LNAPL).** A jar shake test should be performed to identify and determine whether observed tar/free-phase product is either denser or lighter than water. In addition, MGP residues can include both light and dense phases - this test can help determine if both light and dense phase materials are present at a particular location.

l. **Viscosity of Free-Phase Product –** If free-phase product/tar is present a qualitative description of viscosity should be made. Descriptors such as:

   Highly viscous (e.g. taffy-like)
   Viscous (e.g. No. 6 fuel oil or bunker crude like)
   Low viscosity (e.g. No. 2 fuel oil like)

11. A Photoionization Detector (PID) or Flame Ionization Detector (FID) will be used to screen all soil samples at the core location at 6- to 12-inch intervals. This screening data may be used to aid in selection of specific analytical sampling intervals. In addition, the PID or FID will be used to screen samples using the jar headspace method described below in subsection 4.5. The maximum readings from the jar headspace screening will be recorded and included on the logs. A PID/FID will be calibrated daily at a minimum.

4.5 Soil Screening Procedure

The objective of field screening of soils is to measure the relative concentrations of volatile organic compounds (VOCs) present in soil at the project site. This information can be used to: 1) segregate soil based upon the degree of impacts, 2) to identify samples for laboratory analysis of VOCs, and 3) as a qualitative method to evaluate the presence or absence of VOCs in soils. A PID or FID may be used.

Procedure

1. Prior to sampling event, the instrument must be calibrated to the appropriate standard and have the appropriate detector for the contaminants expected to be encountered at the site. The type of standard and detector to be used are indicated in the QAPP.

2. Record background readings of atmospheric conditions in the work area while walking across the work area. The highest meter response should be recorded in the field notebook.

3. Fill a clean, glass jar approximately half way with soil. Use a clean stainless steel sampling implement. Quickly cover the top of the jar with a sheet of aluminum foil and affix the lid to the jar. Each jar should be labeled to indicate the sample location and depth from which the sample was collected.

4. Allow the soil to volatilize for at least 10 minutes. Shake vigorously at the beginning and at the end of the headspace development period. If ambient temperatures are below 50 °F, headspace development should occur, if possible, with a heated area.

5. After headspace development, gently remove the screw cap and expose the foil seal. Quickly puncture the foil seal with the instruments tip to approximately ½ of the headspace depth.

6. Following the probe insertion through the foil seal, record the highest meter response as the jar headspace concentration. Maximum response should occur within 3 to 5 seconds after probe insertion.

Precautions:

- Follow safety procedures defined within the Skillman Street Health and Safety Plan.
- The various instruments may work poorly in rain, high humidity, or in cold temperatures. In these instances, headspace readings will be completed in dry or warm areas.

- Care must be taken to prevent water or soil particulates from entering the tip of the instrument. If this occurs, the probe tip should be cleaned before further use.
- While establishing background conditions and performing jar headspace screening, care should be taken to avoid extraneous VOC sources such as vehicle emissions or other organic vapor sources.

Reference:

1. GEI Consultants, Inc. Standard Operating Procedure (SOP) No. TE-001 [VOC Field Screening] February 6, 1995.

4.6 Air Monitoring Procedure

Air monitoring will be conducted as specified in the Work Plan and the Health and Safety Plan (HASP) dated July 2007 that is provided as part of the Site Characterization Work Plan. Air monitoring will be conducted utilizing a PID during all intrusive subsurface soil sampling activities. A multiple gas meter will be used to monitor will be used to monitor for total VOCs, hydrogen cyanide, hydrogen sulfide, lower explosive limit (LEL), percent oxygen during intrusive subsurface soil sampling activities. During subsurface soil sampling, particulate monitoring will be conducted with a mini-ram digital particulate meter up wind and downwind of the work zone. All monitoring equipment will be calibrated at the beginning of the day and more frequently, if needed, with manufacturer specified calibration gas.

4.7 Quality Assurance/Quality Control

There are no specific QA activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site logbooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

4.8 Sample Labeling Procedure

All samples collected will be labeled in accordance with the table listed below.

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES	**FIELD BLANKS**
Boring -ID (SAMPLE DEPTH-FEET)	SAMPLE-ID – [DATE]
SSGP-01 (10-15)	SSGP-FB-033107

PRIMARY SAMPLES TYPES	QA/QC SAMPLE TYPES
GROUNDWATER SAMPLES	SSMW-FB-033107
Monitoring Well-ID	SSGW-FB-033107
SSMW-01	**MATRIX SPIKE/DUP**
Temporary Groundwater Monitoring Point-ID	SAMPLE [ID] [DEPTH] [EITHER MS OR MSD]
(SAMPLE DEPTH-FEET)	SSGP-01 (10-15) MS/MSD
SSGW-01 (10-14)	SSMW-01 (10-15) MS/MSD
SOIL VAPOR SAMPLES	SSGW-01 (10-15) MS/MSD
Soil Vapor-ID	**TRIP BLANKS**
SSSV-01	SAMPLE- ID [DATE]
INDOOR AIR SAMPLES	RSTB-033107
Indoor Air-ID	**BLIND DUPLICATES**
SSIA-01	SAMPLE -ID[XX][DATE]
OUTDOOR AIR SAMPLES	SSGP-XX-033107
Outdoor Air-ID	SSMW-XX-033107
SSOA-01	SSGW-XX-033107
	SSSV-XX-033111

In addition to the information listed above, each sample will be labeled with the date and time the sample was collected, laboratory analysis requested, initials of the sampler (s), and the project number. Sample handling procedures are located in the QAPP.

References

ASTM *D 2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).* ASTM International, West Conshohocken, PA.

ASTM *D 2487, Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).* ASTM International, West Conshohocken, PA.

5. Monitoring Well Installation and Development

Monitoring wells will be installed at the locations identified in the Work Plan. After the completion of drilling and monitoring well installation, all permanent wells will be developed prior to the collection of groundwater samples. The following procedures will be used to install and develop all monitoring wells.

5.1 Monitoring Well Specifications

Monitoring wells installed in unconsolidated deposits that do not penetrate a presumed confining layer will be constructed according to the following specifications:

1. Install PVC 1.5-inch diameter, threaded, flush-joint casing and Pre-packed 2.5-inch outer diameter, 1.5-inch inner diameter screens.

2. Wells will be screened in the unconsolidated deposits. Screens will be 10 feet in length, and slot openings will be 0.010 inch. Alternatives may be used at the discretion of the field geologist, based on site-specific geologic conditions.

3. If appropriate, a sump, at least 2 feet in length, may be attached to the bottom of the screen to collect dense non-aqueous phase liquids (DNAPLs).

4. Where appropriate, the annulus around the screens will be backfilled with clean silica sand (based on Site-specific geologic conditions and screen slot size) to a minimum height of 1 to 2 feet above the top of the screen.

5. A bentonite pellet seal or a bentonite slurry will be placed above the sand pack. If a pellet seal is used, it will be allowed to hydrate for at least 30 minutes before placement of grout above the seal. Where possible, the bentonite pellet seal will be a minimum of 24-inches in depth, except in those instances where the top of the well screen is in close proximity to the ground surface. In these instances, the well will be completed in accordance with specifications provided by the field geologist who will incorporate an adequate surface seal into the well design.

6. The remainder of the annular space will be filled with a cement grout up to the ground surface. The grout will be pumped from the bottom up. The grout will be mixed in the following relative proportions: One 94-pound bag Type I Portland cement, 3.9 pounds powdered bentonite, and 7.8 gallons potable water. The grout will be allowed to set for a minimum of 48 hours before wells are developed.

7. The top of the casing will be finished using flush-mount casings with keyed-alike locks.

8. A concrete surface pad will be sloped to channel water away from the well casing.

9. A weep hole will be drilled at the base of the protective standpipe casing to allow any water between the inner and outer casing to drain.

10. The top of the PVC well casing will be marked and surveyed to 0.01 foot, and elevations will be determined relative to a fixed benchmark or datum. The measuring point on all wells will be on the innermost PVC casing.

11. Characteristics of each newly installed well will be recorded in the field notebook.

References:

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

5.2 Monitoring Well Development

After a minimum of 48 hours after completion, one or a combination of the following techniques will be used in the monitoring well development:

1. Surging;
2. Bailing;
3. Using a centrifugal pump and dedicated polyethylene tubing; and/or
4. Positive displacement pumps and dedicated polyethylene tubing.

Development water will initially be monitored for organic vapors with a PID. In addition, the development water will be observed for the presence of non-aqueous phase liquids (NAPLs) or sheens. The development water will be contained in a tank and/or 55-gallon steel drums on-site. The purge water will be disposed of in accordance with NYSDEC requirements. The wells will be developed until the water in the well is reasonably free of visible sediment (<50 NTU if possible). Well development will not exceed 10 well volumes. Following development, wells will be allowed to recover for at least two weeks before groundwater is purged and sampled. All monitoring well development will be overseen by a field representative and recorded in the field logbook.

References:

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

6. Groundwater Sampling Procedure

The following is a step-by-step sampling procedure to be used to collect groundwater samples from the monitoring wells and temporary groundwater monitoring points. Well sampling procedures will be recorded in the field notebook. Sample management is detailed in the QAPP.

1. Groundwater samples will not be collected until at minimum, two weeks following well development of permanent wells.

2. Prior to sampling, a round of groundwater elevation measurements will be collected. The measurements will be made from the surveyed well elevation mark on the top of the inner PVC casing with a decontaminated electric water/product level probe. The measurements will be made in as short a time frame as practical to minimize temporal fluctuations in hydraulic conditions. The time, date, and measurement to nearest 0.01 foot will be recorded in the field logbook;

3. Place a plastic sheet on the ground to prevent contamination of the bailer rope and/or the tubing associated with the purging (pump) equipment;

4. Each monitoring well will be purged with a centrifugal, submersible, peristaltic, or whale pump and dedicated polyethylene tubing, or other methods at the discretion of the field geologist, and with the prior approval of National Grid and NYSDEC

5. Monitoring wells will be purged at a rate to minimize drawdown within the well to the extent practicable.

6. The water quality parameters of temperature, pH, conductivity, oxygen reduction potential, turbidity, and DO will be measured and recorded, at 3 to 5 minute intervals with a multi-parameter water quality probe. At least, 1 well volume of water will be removed prior to sampling. When the parameters stabilize over 3 consecutive readings, sampling may commence. Stability is achieved when pH is within 0.1 standard unit, temperature is within 0.5ºC, Eh is within 10% and specific conductivity is within 10% for three consecutive readings. Record results in the field logbook prior to sample collection;

7. Collect VOC samples with a dedicated polyethylene bailer lowered by a dedicated polypropylene rope or other methods as indicated. Other parameters may be collected with a submersible, or peristaltic pump using the low-flow sampling technique. The pump should be capable of throttling to a low flow rate suitable for sampling;

8. If the well goes dry before the required volumes are removed, the well may be sampled when it recovers sufficiently;

9. After all samples are collected, the water level in the monitoring well will be gauged and the locking cap will be re-installed.

10. Investigation derived water, PPE, and dedicated sampling equipment will be disposed of in garbage bags or stored in temporary 5-gallon containers.

References:

1. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

2. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples From Monitoring Wells,* published July 30, 1996 by the United States Environmental Protection Agency (EPA).

7. Soil Vapor and Ambient Air Sampling Procedure

7.1 Soil Vapor Sample Collection

This set of procedures outlines the general steps to collect soil vapor samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

7.1.1 Soil Vapor Probe Installation

Permanent and temporary soil vapor probes will be installed using the procedure outlined below:

- Record weather information (temperature, barometric pressure, rainfall, wind speed, and wind direction). Record substantial changes to these conditions that may occur during the course of the probe installation. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Install soil vapor probes using a direct-push drill rig (e.g., GeoProbe® or similar) or manually using a slide hammer. Probes will consist of stainless-steel drive points with stainless steel screens attached to food-grade (inert) Teflon or polyethylene tubing through which the soil vapor sample will be drawn.
- Attach the drive points to a drive rod (stainless-steel tube) and drive the rod to the target depth, as define in the work plan.
- Withdraw the drive rods from the hole, leaving the drive point and tubing.
- Place filter pack material, such as glass beads or clean silica sand, in the annular space surrounding the tubing directly above the sample point to a height of approximately 1 to 2 feet. The depth of the filter pack material should always be adequate to prevent the bentonite slurry above from going over the drive point and sample inlet screen.
- Place bentonite slurry in the annulus above the filter pack material to provide a seal in the borehole. Ideally, place the bentonite annular seal at least 3 feet thick, although adjustments to this thickness may be required based on site-specific conditions. The entire borehole must be filled to the ground surface with either entirely bentonite or with natural fill between two bentonite seals (one above the filter pack material and one at the ground surface). Permanent installations must have a surface seal made of cement or cement/bentonite grout.
- For permanent installations, install flush-mounted protective covers to protect the probe and the tubing.
- Cut the end of the tubing to allow proper closure of the flush-mounted protective cover, but with a sufficient length of tubing exposed at the surface to facilitate connection of sampling equipment.

- Close or cap the sample tubing following installation and following collection of each sample.

7.1.2 Collection of Soil Vapor Samples

Collecting soil vapor samples will be accomplished by using the following procedure:

- Record weather information (i.e., temperature, barometric pressure, rainfall, wind speed, and wind direction) at the beginning of the sampling event. Also, record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Identify sampling locations on a plot plan that also identifies buildings, other landmarks, and potential sources of VOC contamination to both the surface and outdoor air. Record the depth of the probe screen below grade.
- If necessary, connect additional tubing to the tubing extending from the soil vapor probe to allow for connection to sample collection equipment.
- Calculate the volume of air in the probe, tubing (volume = $\pi r^2 h$), including any additional tubing added in the step above and the annular space between the probe and the native material if sand or glass beads were used.
- Connect a vacuum pump or gas-tight syringe (~60 cubic centimeters [cc]) to the sample tubing. At a flow rate of no more than 0.2 liter per minute (lpm), purge air from the tubing until one to three of the above-calculated air volumes are removed.
- During purging, evaluate the potential for ambient air to be introduced in the soil vapor sample through the annulus of the soil vapor probe or tubing connections using a tracer gas such as helium. The procedures for the tracer gas evaluation are described below. Note that the bentonite used in the probe installation should have sufficient time to seal before the samples are collected. The tracer gas evaluation will verify if the seal is sufficient.
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the soil vapor sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as identified in the project-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be batch certified as clean by the laboratory.
- Remove the protective brass plug from the canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by

the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.

- Connect the tubing from the soil vapor probe to the flow controller.
- Completely open the valve on the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling.
- Stop sample collection when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).
- Provided that no additional sampling is expected to be conducted, either pull out (if practical) or abandon in place the sampling probe. When abandoning, cut the tubing back as far down as practical and cover to surface with native soil.

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

7.1.3 Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample. A tracer gas evaluation should be conducted on all soil vapor probes. After the initial round of sampling and with the approval of the regulating agency, the use of tracer gas may be reduced to a minimum of 10 percent for permanent and semi-permanent probes if the initial round results showed installations with competent seals.

The following tracer gas evaluation procedure uses in-field tracer gas measurements and tracer gases (e.g., helium) that can be measured by portable detectors.

- Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. A tracer gas detector will be attached to the valve fitting at the bottom of the chamber to verify the presence of the tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >50%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior measuring the tracer gas concentration.
- Use the tracer gas detector to measure the tracer gas concentration in the pump exhaust.
- Record the tracer gas concentrations in the chamber and in the soil vapor sample. If the evaluation indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement of the sample collection. A non-detectable level of tracer gas is preferred; however, if the evaluation indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

7.2 Sub-Slab Soil Vapor Collection

This set of procedures outlines the general steps to collect sub-slab vapor samples. The Work Plan should be consulted for proposed sample locations, sample depths, and sampling duration.

7.2.1 Sub-Slab Vapor Probe Installation

Temporary sampling probes will be installed using the following procedures:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- If appropriate, record weather information (temperature, barometric pressure, rainfall, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Identify sampling location(s) on a floor plan that also identifies any slab breeches (e.g., utility penetrations, sumps, drains, and cracks) and locations of Heating, Ventilating, and Air Conditioning (HVAC) equipment.
- Insert a section of food-grade (inert) Teflon® or other appropriate tubing through a 3/8-inch (approx.) hole drilled through the slab. If necessary, advance the drill bit 2 to 3 inches into the sub-slab material to create an open cavity.
- Install the tubing inlet to the specified sampling depth below the slab, not to exceed 2 inches.
- Seal the annular space between the hole and tubing using 100% beeswax or another inert, non-shrinking sealing compound such as permagum.

7.2.2 Sub-Slab Vapor Sample Collection

Sub-slab vapor samples will be collected by following the steps outlined below.

- Purge the tubing using a vacuum pump or gas-tight syringe (~60 cc). Calculate the volume of air (volume = _π r^2h) in the tubing and purge one to three tubing volumes prior to sample collection at a rate no greater than 0.2 liter per minute (lpm).
- Use an evacuated Summa® passivated (or equivalent) canister to collect the sub-slab vapor sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be batch certified as clean by the laboratory.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of-custody form for each sample.
- Connect the tubing from the sub-slab vapor sampling probe to the flow controller.

- Completely open the valve on the canister. Record the time that the valve is opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical).
- Complete the NYSDOH building survey and chemical survey form.
- Stop sample collection after the scheduled duration of sample collected, but when the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valve. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).
- For temporary probes, remove the probe and seal the slab hole with cement. Repair flooring, if any.

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

7.2.3 Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the soil vapor probe seal and assess the potential for introduction of ambient air into the soil vapor sample. A tracer gas evaluation should be conducted on all soil vapor probes. After the initial round of sampling and with the approval of the regulating agency, the use of tracer gas may be reduced to a minimum of 10 percent for permanent and semi-permanent probes if the initial round results showed installations with competent seals.

The following tracer gas evaluation procedure uses in-field tracer gas measurements and tracer gases (e.g., helium) that can be measured by portable detectors.

- Retain the tracer gas around the sample probe by filling an air-tight chamber (such as a plastic bucket) positioned over the sample location.
- Make sure the chamber is suitably sealed to the ground surface.
- Introduce the tracer gas into the chamber. The chamber will have tubing at the top of the chamber to introduce the tracer gas into the chamber and a valved fitting at the bottom to let the ambient air out while introducing tracer gas. A tracer gas detector will be attached to the valve fitting at the bottom of the chamber to verify the presence of the tracer gas. Close the valve after the chamber has been enriched with tracer gas at concentrations >50%.
- The chamber will have a gas-tight fitting or sealable penetration to allow the soil vapor sample probe tubing to pass through and exit the chamber.
- After the chamber has been filled with tracer gas, attach the sample probe tubing to a pump that will be pre-calibrated to extract soil vapor at a rate of no more than 0.2 lpm. Purge the tubing using the pump. Calculate the volume of air in the tubing and probe and purge one to three tubing/probe volumes prior measuring the tracer gas concentration.
- Use the tracer gas detector to measure the tracer gas concentration in the pump exhaust.
- Record the tracer gas concentrations in the chamber and in the soil vapor sample. If the evaluation indicates a high concentration of tracer gas in the sample (>10% of the concentration of the tracer gas in the chamber), then the surface seal is not sufficient and requires improvement via repair or replacement prior to commencement of the sample collection. A non-detectable level of tracer gas is preferred; however, if the evaluation indicates a low potential for introduction of ambient air into the sample (<10% of the concentration of the tracer gas in the chamber), then proceed with the soil vapor sampling. While lower concentrations of tracer gas are acceptable, the impact of the detectable leak on sample results should be evaluated in the sampling report.

7.3 Indoor Air Sample Collection

This set of procedures outlines the general steps to collect indoor air samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sampling locations and other indoor air requirements (inventory, etc.).

Indoor air samples will be collected by following the steps outlined below:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Record weather information (temperature, barometric pressure, relative humidity, wind speed, and wind direction) and indoor temperature and humidity at the beginning of the sampling event. Record substantial changes to these conditions that may have occurred over the past 24 to 48 hours and that do occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Identify sampling location(s) on a floor plan that also identifies locations of HVAC equipment, chemical storage areas, garages, doorways, stairways, sumps, drains, utility perforations, north direction, and separate footing sections
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the outdoor air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.
- Place the canister at the sampling location. The sample should be collected from breathing height (e.g., 3 to 5 feet above ground). Either mount the canister on a stable platform or attach a length of inert tubing to the flow controller inlet and support it such that the sample inlet will be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.
- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge.
- Complete the NYSDOH building survey and chemical survey form.
- Stop sample collection after the scheduled duration of sample collection, but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.

- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

7.4 Ambient Air Sample Collection

This set of procedures outlines the general steps to collect ambient air samples. The site-specific Sampling and Analysis Work Plan should be consulted for proposed sample locations and sampling duration.

The following procedures will be followed for the collection of ambient air samples:

- Sampling personnel must avoid activities immediately before and during the sampling that may contaminate the sample (e.g., using markers, fueling vehicles, etc.).
- Select a location upwind of the building or other area that is being evaluated. If possible, select a location upwind or near the HVAC air intake for the building being sampled.
- Record weather information (i.e., temperature, barometric pressure, relative humidity, wind speed, and wind direction) at the beginning of the sampling event. Record substantial changes to these conditions that may occur during the course of sampling. The information may be measured with on-site equipment or obtained from a reliable source of local measurements (e.g., a local airport).
- Use an evacuated Summa® passivated (or equivalent) stainless-steel canister to collect the ambient air sample. The canister will be provided by the laboratory, along with a flow controller equipped with an in-line particulate filter and a vacuum gauge. The flow controller will be pre-calibrated by the laboratory for the desired flow rate or duration of sample collection, as defined in the site-specific work plan. The sampling flow rate should always be less than 0.2 lpm. The canisters will be individually certified as clean by the laboratory.

- Place the canister at the sampling location. If the sample should be collected from breathing height (e.g., 3 to 5 feet above ground), then mount the canister on a stable platform such that the sample inlet will be at the proper height.
- Remove the protective brass plug from canister. Connect the pre-calibrated flow controller to the canister.
- Record the identification numbers for the canister and flow controller. Record the initial canister pressure on the vacuum gauge (check equipment-specific instructions for taking this measurement). A canister with a significantly different pressure than originally recorded by the testing laboratory should not be used for sampling. Record these numbers and values on the chain-of custody form for each sample.
- Completely open the valve on the vacuum pressure in the canister. Record the time that the valve was opened (beginning of sampling) and the canister pressure on the vacuum gauge.
- Photograph the canister and the area surrounding the canister.
- Document on a field form an outdoor plot sketch that indicates the building being sampled, streets, sampling location, location of potential outdoor air sources, north direction and paved areas. Also record pertinent observations such as odors, readings from field instrumentation, and significant activities in the vicinity that result in air emissions.
- Monitor the vacuum pressure in the canister routinely during sampling, when practical (sometimes the canister will sample over a 24-hour period and routine monitoring is not practical). During monitoring, note the vacuum pressure on the gauge.
- Stop sample collection after the scheduled duration of sample collection but make sure that the canister still has a minimum amount of vacuum remaining. Check with the laboratory supplying the canister and flow controller for the ideal final vacuum pressure. Typically, the minimum vacuum is between 2 and 5 inches of mercury, but not zero. If there is no vacuum remaining, the sample will be rejected and collected again in a new canister.
- Record the final vacuum pressure and close the canister valves. Record the date and time that sample collection was stopped.
- Remove the flow controller from the canister and replace the protective brass plug.
- Attach labels/tags (sample name, time/date of sampling, etc.) to the canister as directed by the laboratory.
- Place the canister and other laboratory-supplied equipment in the packaging provided by the laboratory.
- Enter the information required for each sample on the chain-of-custody form, making sure to include the identification numbers for the canister and flow controller, and the initial and final canister pressures on the vacuum gauge.
- Include the required copies of the chain-of-custody form in the shipping packaging, as directed by the laboratory. The field crew will retain a copy of the chain-of-custody for the project file.

- Deliver or ship the samples to the laboratory within one business day of sample collection and via overnight delivery (when shipping).

All laboratory analytical data will be validated by a data validation professional in accordance with the USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, January 2005 and the USEPA Region II SOP for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

References

1. *Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York,* New York State Department of Health, October 2006.

2. *Draft Standard Operating Procedure for Soil Vapor Intrusion Evaluations at National Grid Sites in New York State,* National Grid, March 2008.

8. Equipment Decontamination Procedure

The following equipment decontamination procedure is applicable for use in decontaminating sampling tools used in collection of analytical samples from subsurface soils and groundwater. Equipment decontamination will prevent cross-contamination and maintain analytical sample integrity. This procedure may be varied or changed as required, dependent upon site conditions and equipment limitations. Any deviation from this standard should be documented in the field-sampling book and in the final report.

8.1 Equipment/Apparatus

Equipment needed for decontamination of sampling equipment may include:

- Alconox or non-phosphate soap
- Simple Green
- Methanol
- 10% Nitric acid solution
- De-ionized water
- Decontamination buckets
- Secondary containment vessels
- Plastic sheeting
- Scrub brushes
- Personal protection equipment (PPE)

8.2 Equipment Decontamination Procedure

Equipment will be decontaminated in accordance with procedures specified in the Work Plan as summarized below. Equipment decontamination procedures are also detailed within the QAPP.

8.2.1 Sampling Equipment and Tools

Prior to sampling, all non-dedicated equipment (i.e., bowls, spoons, bailers, and soil sampling apparatus (i.e., Macro-Core Shoe and split spoon equipment) will be decontaminated as follows.

- Decontamination of sampling equipment and hand tools may take place at the sampling location as long as all liquids are contained in pails, buckets, etc.
- All sampling equipment will be washed with water and a non-phosphate detergent (Alconox, Simple Green, etc.) to remove gross contamination.
- All sampling equipment will then be rinsed with de-ionized water.

- All equipment used to collect samples for VOCs and SVOC analysis will then receive a methanol rinse followed by a de-ionized water rinse.
- All equipment used to collect samples for metals analysis will then receive a 10% nitric acid solution rinse followed by a de-ionized water rinse.
- At no time will decontaminated equipment be placed directly on the ground.
- Equipment will be wrapped in polyethylene plastic or aluminum foil for storage or transportation from the designated decontamination area to the sampling location, where appropriate.

8.2.2 Drill Rig Decontamination

For site characterization activities, the GeoProbe® rig drilling implements will be decontaminated with water and a non-phosphate detergent and water rinse. Decontamination will be completed in close proximity to the proposed borings and will be completed over a temporary decontamination pad or plastic containers because of site constraints. The macro-core sampling shoe will be decontaminated in accordance with subsection 8.2.1.

In the event that conventional hollow stem auger drilling or resonant sonic drilling is used, then a temporary decontamination pad or tubs will be used. All augers, rods, and tools will be decontaminated between each drilling location according by steam cleaning. Decontamination water will be containerized an stored in temporary 5-gallon buckets for off-site disposal.

8.3 Quality Assurance/Quality Control

There are no specific quality assurance (QA) activities that apply to the implementation of these procedures. However, the following general QA procedures apply:

- All data must be documented on field data sheets or within site field notebooks.
- All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

References

1. ASTM *E 1391-94, Standard Guide for Collection, Storage, Characterization, and Manipulation of Sediments for Toxicological Testing.* 2000 ASTM Standards on Environmental Sampling, Vol 11.05, West Conshohocken, PA.

2. Puget Sound Estuary Program, 1997. *Recommended Guidelines for Sampling Marine Sediment, Water Column, and Tissue in Puget Sound.* U.S. Environmental Protection Agency, Region 10, Seattle, WA and Puget Water Quality Authority, Olympia, WA.

3. U.S. Environmental Protection Agency, 1993. U.S. EPA Contract Laboratory Program – Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration. Document ILMO1.0-ILO-1.9, 1993. U.S. Environmental Protection Agency, Washington, DC.

4. GEI Consultants, Inc. Standard Operating Procedure (SOP) No. SA-007 [Equipment Decontamination].

5. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

9. Analytical Sample Handling and Transport

Subsurface soils collected will be handled and submitted for laboratory analysis according to the following procedure. The QAPP provides a detail description of sample handling and transport.

1. Samples will be transferred from the sample equipment into suitable, labeled sample containers specific for the laboratory analyses to be performed. Use laboratory-provided, pre-preserved sample bottles for specific analyses. Do not overfill bottles if they are pre-preserved.

2. Secure the sample container with the appropriate cap, place the sample container in a resealable plastic bag or bubble wrap, and place it inside of a sample cooler provided by the laboratory. Use ice to cool the sample cooler to 4 degrees Celsius.
3. Record all pertinent sample identification data in the site database an/or field notebook.

4. Print the completed the Chain-of-Custody (COC) record from the database, sign, and photocopy. If necessary, a hard copy COC may be used in the place of the electronic database. A chain of custody is attached in Appendix C. Place the original COC in a resealable plastic bag and affix it to the inside of the top of the cooler/or will transmitted to the laboratory courier upon a sample pick-up.

5. Attach a custody seal to the outside of the cooler prior to shipment/pickup.

10. Investigation-Derived Waste Handling Procedure

10.1General Waste Handling Procedures

The following procedure provides guidelines for the management of investigation derived wastes. Wastes anticipated to be generated as part of the Skillman Street Site Characterization include the following materials: subsurface soils, groundwater, decontamination fluids, PPE, and miscellaneous investigation-derived field supplies. All wastes will be segregated into soil, fluids and PPE/miscellaneous investigation-derived materials will be stored in temporary 5–gallon storage containers or garbage bags. Investigation derived wastes will be picked at the end of the work day by a licensed National Grid waste hauler or will be placed in United States Department of Transportation (USDOT)-approved 55-gallon drums at a temporary storage facility. Each waste vessel will labeled with a “Non-Hazardous Waste Label” designated with “Pending Characterization.”

Information on the label should include:

Generator: The Brooklyn Union Gas Company
Address: 1 MetroTech Center Brooklyn, NY 11201

At the end of each day, each waste container should be secured with temporary 5-gallon containers and trash bags until it is either picked up by a private waste carrier at the end of each work day, or staged at a temporary waste storage facility. GEI field representative will document the number and type of investigation derived wastes. Investigation -derived wastes will be documented on the waste tracking sheet and provided to the National Grid Project Manager. A waste tracking sheet is attached in Appendix D.

10.2 Investigation Derived Waste Sample Collection Procedure

If required, the GEI field representative will obtain a waste profile sample of soil and fluid investigation derived wastes. A sample will be collected from each of the investigation-derived wastes that require analysis for disposal. Soil wastes will be collected by using shovels, hand auger or other equipment, composited and then placed into laboratory provided sample jars. The waste profile parameters will be provided to the GEI field representative prior to collection of the waste profile sample. Samples will be collected into laboratory-preserved bottles, chilled with ice and submitted to the laboratory under chain of custody as described in above Section 9.

References

1. GEI Consultants, Inc. Standard Operating Procedure (SOP) No. RE-006 [Investigation Derived Waste Management]
2. Field Sampling Plan For Site Investigations At Manufactured Gas Plants, KeySpan Corporation, March 2004.

Appendix A

Daily Activity Report

DAILY ACTIVITY REPORT

DATE:		**GEI Personnel:**	
PROJECT:		**National Grid Personnel:**	
GEI PROJECT NO.:		**Other Personnel:**	
SITE LOCATION:		**NYSDEC Personnel:**	
		Site Visitors:	

Description of Activities and Summary of Significant Field Observations (Indicate Times as Appropriate)

____
____
____
____
____
____
____
____
____
____
____
____

Drilling Summary

Completed Boring ID	Completed Well ID	Total Depth of Soil Sampling	Well Screen Bottom Depth	Well Screen Top Depth	Isolation Casing Depths	Other

Summary of Soil Samples Submitted for Laboratory Analyses

Soil Sample ID	Boring ID	Depth Interval	Time Collected	Analyses Requested	Duplicate Sample ID	MS/MSD (yes/no)

Summary of Groundwater Samples Submitted for Laboratory Analyses

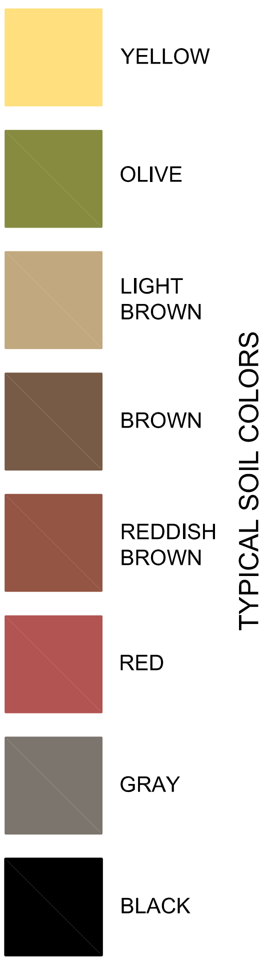
Groundwater Sample ID	Well ID	Time Collected	Analyses Requested	Sample Tube Intake Depth	Purge/Sample Flow Rate	Duplicate Sample ID

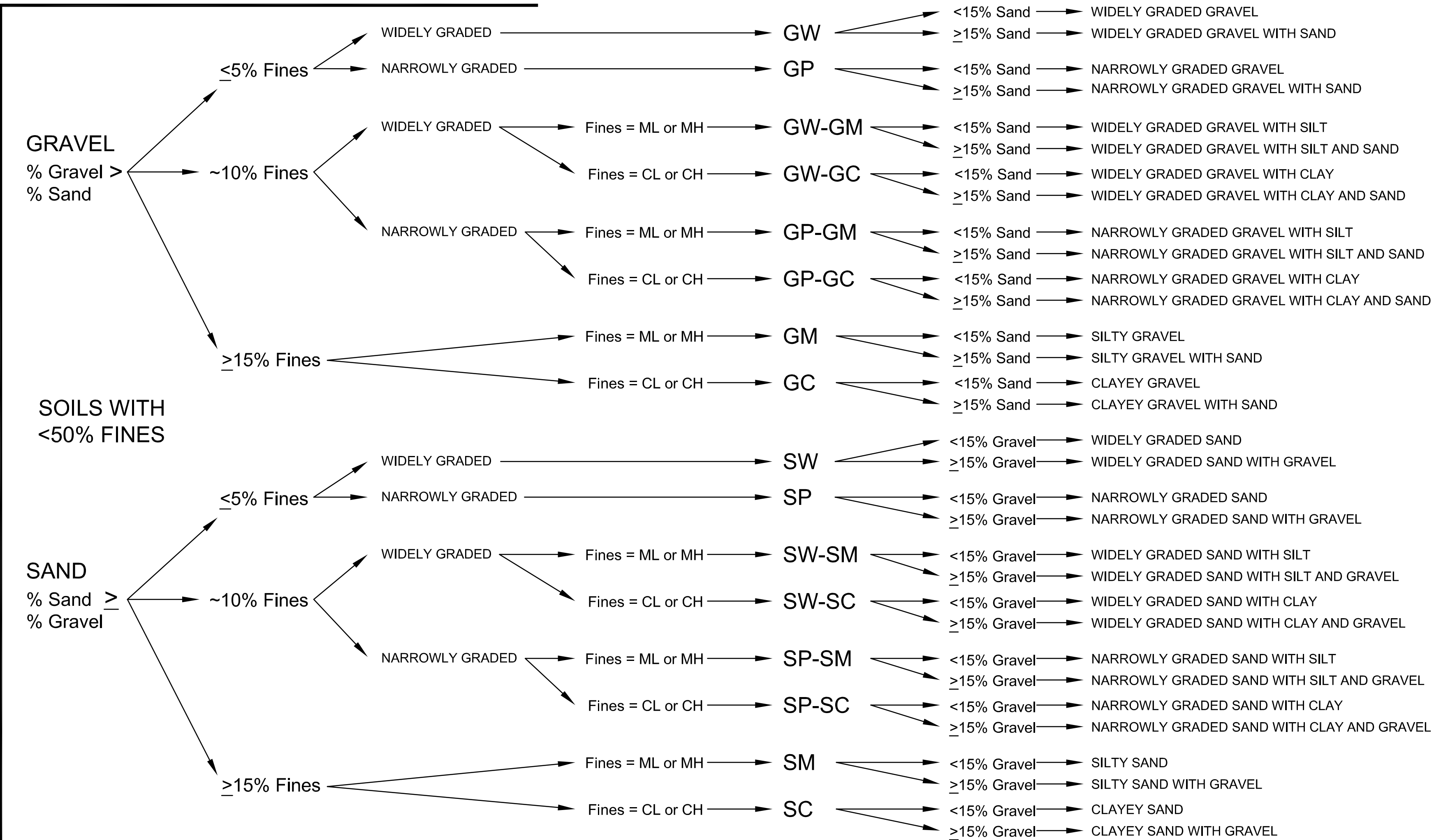
Appendix B

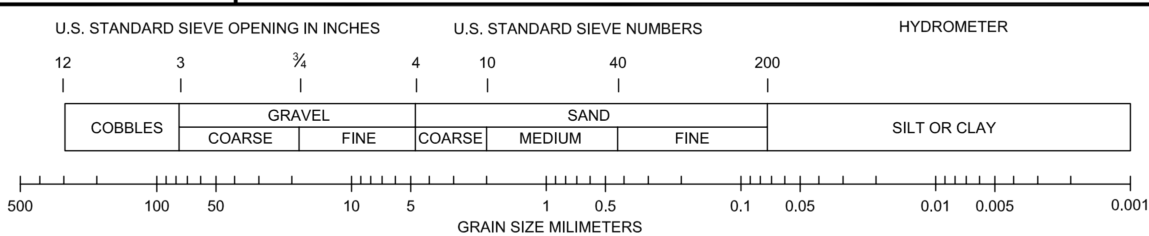
Visual-Manual Description Standards

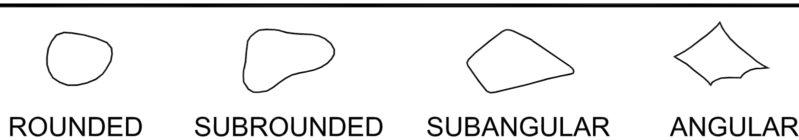
COARSE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS









1. GROUP NAME and (SYMBOL)
2. Structure , if any. (stratified layer thicknesses, lenses, varves, gradational changes)
3. Describe sand, gravel and fines components, with percentages, in order of predominance. Include max gravel size. For test pits give percent cobbles and boulders, by volume, and include max size.
4. Color
5. Sheen, odor, roots, ash, brick, cementation, reaction with HCL, etc.
6. "Fill," local name or geologic name, if known

GEI Consultants

FINE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS

SOILS WITH ≥50% FINES

CL	<30% plus No. 200	<15% plus No. 200		LEAN CLAY
		15-25% plus No. 200	% Sand ≥% Gravel	LEAN CLAY WITH SAND
			% Sand <% Gravel	LEAN CLAY WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY LEAN CLAY
			≥15% Gravel	SANDY LEAN CLAY WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY LEAN CLAY
			≥15% Sand	GRAVELLY LEAN CLAY WITH SAND
ML	<30% plus No. 200	<15% plus No. 200		SILT
		15-25% plus No. 200	% Sand ≥% Gravel	SILT WITH SAND
			% Sand <% Gravel	SILT WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY SILT
			≥15% Gravel	SANDY SILT WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY SILT
			≥15% Sand	GRAVELLY SILT WITH SAND
CH	<30% plus No. 200	<15% plus No. 200		FAT CLAY
		15-25% plus No. 200	% Sand ≥% Gravel	FAT CLAY WITH SAND
			% Sand <% Gravel	FAT CLAY WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY FAT CLAY
			≥15% Gravel	SANDY FAT CLAY WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY FAT CLAY
			≥15% Sand	GRAVELLY FAT CLAY WITH SAND
MH	<30% plus No. 200	<15% plus No. 200		ELASTIC SILT
		15-25% plus No. 200	% Sand ≥% Gravel	ELASTIC SILT WITH SAND
			% Sand <% Gravel	ELASTIC SILT WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY ELASTIC SILT
			≥15% Gravel	SANDY ELASTIC CLAY WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY ELASTIC SILT
			≥15% Sand	GRAVELLY ELASTIC SILT WITH SAND
OL/OH	<30% plus No. 200	<15% plus No. 200		ORGANIC SOIL
		15-25% plus No. 200	% Sand ≥% Gravel	ORGANIC SOIL WITH SAND
			% Sand <% Gravel	ORGANIC SOIL WITH GRAVEL
	≥30% plus No. 200	% Sand ≥% of Gravel	<15 % Gravel	SANDY ORGANIC SOIL
			≥15% Gravel	SANDY ORGANIC SOIL WITH GRAVEL
		% Sand <% of Gravel	<15 % Sand	GRAVELLY ORGANIC SOIL
			≥15% Sand	GRAVELLY ORGANIC SOIL WITH SAND

ID OF INORGANIC FINE SOILS FROM MANUAL TESTS

Symbol	Name	Dry Strength	Dilatancy	Toughness*
ML	Silt	None to low	Slow to rapid	Low or thread cannot be formed
CL	Lean Clay	Medium to high	None to slow	Medium
MH	Elastic Silt	Low to medium	None to slow	Low to medium
CH	Fat Clay	High to very high	None	High

1. GROUP NAME and (SYMBOL)
2. Describe fines, sand, and gravel components, in order of predominance. Include plasticity of fines. Include percentages of sand and gravel.
3. Color
4. Sheen, odor, roots, ash, brick, cementation, torvane and penetrometer results, etc.
5. "Fill," local name or geologic name, if known

PEAT

Peat refers to a sample composed primarily of vegetable matter in varying stages of decomposition. The description should begin: PEAT (PT) and need not include percentages of sand, gravel or fines.

CRITERIA FOR DESCRIBING PLASTICITY

Description	Criteria
Nonplastic ML	A 1/8-in. (3 -mm) thread cannot be rolled at any water content
Low Plasticity ML, MH	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit *
Medium Plasticity MH, CL	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High Plasticity CH	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

* Toughness refers to the strength of the thread near plastic limit. The lump refers to a lump of soil drier than the plastic, similar to dry strength.

Appendix C

Chain-of-Custody

Chain of Custody Record

STL Connecticut
128 Long Hill Cross Road
Shelton, CT 06484
Tel: 203-929-8140

SEVERN TRENT **STL**
Severn Trent Laboratories, Inc.

STL-4124 (0901)

Client	Project Manager	Date	Chain of Custody Number 00732
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page ____ of ____
City / State / Zip Code	Site Contact / Lab Contact		
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			

Analysis (Attach list if more space is needed)

Special Instructions/ Conditions of Receipt

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH														Special Instructions/ Conditions of Receipt

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For ______ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other__________

QC Requirements (Specify)

1. Relinquished By	Date	Time	1. Received By	Date	Time
2. Relinquished By	Date	Time	2. Received By	Date	Time
3. Relinquished By	Date	Time	3. Received By	Date	Time

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Appendix D

Waste Tracking Form

Monthly Tracking Inventory of Former MGP Site Investigation Derived Waste:

Site Name	Address	Project Start Date(dd/mm/yy)	Project Completion Date(dd/mm/yy)	Profile samples collected(Y/N)	Description of Waste On-site			
					55-gal. Drums	Roll-Offs	Frac Tank	Miscellaneous

Appendix J

Site Management Forms

Low-Flow Groundwater Sampling Form

Project number and name ____________ Sampling personnel ____________ Sample date ____________ Well ID ____________

Well location description: ____________

____

Well Construction

Well diameter ____________

Well measurement point ____________

Roadbox condition ____________

Well screen interval ____________

Well depth ____________

Sampling Information

Initial depth to water ____________ Time: ____________

Sample intake depth ____________

Pump type and ID ____________

Stabilized flow rate ____________

Stabilized flow rate = flow rate with no further drawdown

Samples Collected

VOCs 8260	
SVOCs 8270	
VPH	
EPH	
Metals	
PCBs	
Other	

Field values at time of sample collection:

Time: ____________ Depth to water:

Sp.Cond. ____________ mS/cm ____________

DO ____________ mg/L

ORP ____________ mV

pH ____________ s.u.

Temp. ____________ ^{o}C

Turb. ____________ NTU

Cumulative Time (min.)	**Volume (gal)**	**Water depth (ft)**	**Temp. (^{o}C)**	**Sp.Cond. (mS/cm)**	**D.O. (mg/L)**	**pH (s.u.)**	**ORP (mV)**	**Turb. (NTU)**
Typical Groundwater Values			5 to 15	0.05 to 5	0 to 4	5 to 7	-100 to +500	aim for <10

Notes: ____________

Sample Information:

Sample ID ____________

Sample Time: ____________

Color: ____________

Turbidity: ____________

Field Filtered YES / NO Analyses: ____________

Filter type: ____________

Odor/Sheen/NAPL ____________

Duplicate Collected YES / NO

If yes, duplicate ID: ____________

Purge water disposal? to ground drummed other:

Well Volume Conversion:

Diam. (in)	Factor (gal/ft)
1	0.04
1.5	0.09
2	0.16
4	0.65
6	1.50

well volume =
3.14 x (r)^2 x 7.48 gal/ft
where r = 1/2 diameter in ft

Stabilization Criteria:
Sp.Cond. +/- 3%
DO +/- 10%
ORP +/- 10 mV
pH +/- 0.1 Std Units
Temp. +/- 3%
Turb. +/- 10% if values >1 NTU

Guidance:

1 Position tubing at midpoint of saturated screened interval

2 Minimize drop in water level and purge until parameters are stable

3 Disconnect flow thru cell during sampling

4 Call Project Manager if issues arise (e.g. stabilization takes more than 2 hrs, well goes dry, odd data).

5 For VPH and VOC samples, if stabilization flow rate is less than 200 ml/min, contact PM

SITE INSPECTION FORM
Skillman Street Former Holder Station

SITE INSPECTION DATE: ________________ **TIME OF ARRIVAL:** ____________________

DEPARTURE: ____________________

National Grid SIR Representative(s): ____________________

____

INSPECTION TYPE: **Annual Inspection or Emergency Inspection**

(if emergency indicate event that required an inspection): ____________________

____

____

____

Are the Institutional Controls in place, performing properly, and remain effective?

Site Signage in Place? Yes / No

____

Hazard Communication Documents Present? Yes / No

____

____

____

Has ownership of the property changed since the last inspection? Yes / No

(Verify with Real Estate and Survey Departments)

____

____

____

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____

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____

____

____

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SITE INSPECTION FORM
Skillman Street Former Holder Station

Are the Engineering Controls in place, performing properly, and remain effective?

Surface Cover Intact (ie no evidence of erosion, excavations)? Yes / No

GENERAL SITE OBSERVATIONS:

Has there been any changes to the property since the last inspection? Yes / No

(i.e. new equipment or facilities, changes in site topography, erosion, etc.)

COMPLETED BY:	REVIEWED BY:
SIGNATURE:	SIGNATURE:

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