ROCKAWAY PARK FORMER MANUFACTURED GAS PLANT SITE

QUEENS COUNTY

ROCKAWAY PARK, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: 2-41-029

Prepared for:

KeySpan Gas East Corporation, d/b/a National Grid

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Hicksville, NY 11801

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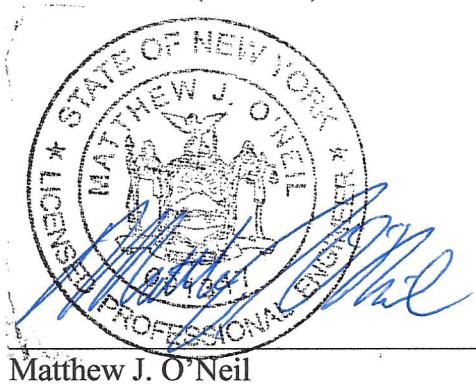
Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
1	3/28/2023	Updated NYSDEC contact information	

APRIL 2022

CERTIFICATION STATEMENT

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



4/26/22
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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List of Acronyms

BTEX	Benzene, Toluene, Ethylbenzene, and Xylene
CAMP	Community Air Monitoring Plan
COC	Certificate of Completion
COCs	Compounds of Concern
D&B	Dvirka and Bartilucci
DER	Division of Environmental Remediation
DNAPL	Dense Non-Aqueous Phase Liquid
EC	Engineering Control
EWP	Excavation Work Plan
HASP	Health and Safety Plan
IC	Institutional Control
MGP	Manufactured Gas Plant
MOU	Memorandum of Understanding
NAPL	Non-Aqueous Phase Liquid
NYCDPR	New York City Department of Parks and Recreation
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	Operation and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbons
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objectives
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RP	Remedial Party and Respondent
RSO	Remedial System Optimization
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency

UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program

ES EXECUTIVE SUMMARY

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

Site Identification: HW 2-41-029 Rockaway Park Former Manufactured Gas Plant (MGP), Rockaway Park, NY

Institutional Controls:	1. The Site may be used for restricted residential, commercial or industrial uses.	
	2. Environmental Easement, Monitoring and Sampling Plan, Memorandum of Understanding (MOU)	
	3. All Engineering Controls (EC) must be inspected annually.	
Engineering Controls:	1. Cover Systems	
Inspections:		Frequency
1. Cover Systems inspection		Annually
Monitoring:		
1. Dense Non-Aqueous Phase Liquid (DNAPL) Recovery and Groundwater Monitoring Wells		Annually
Maintenance:		
1. Cover Systems maintenance		As needed
Reporting:		
2. Periodic Review Report		Annually

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

1.0 INTRODUCTION

1.1 General

This Site Management Plan (SMP) is a required element of the remedial program for the Rockaway Park former Manufactured Gas Plant (MGP) Site located in Rockaway Park, New York (hereinafter referred to as the "Site"). See **Figure 1**. The Site is currently in the New York State (NYS) Inactive Hazardous Waste Disposal Site Remedial Program Site No. 2-41-029 which is administered by New York State Department of Environmental Conservation (NYSDEC).

The Site is located in Rockaway Park, Queens County, New York. For the purposes of this SMP, the Site has been divided into two separate properties, the On-Site Property which is owned by National Grid, and the Off-Site Property which is owned by the New York City Department of Parks and Recreation (NYC DPR).

The former Gas Works and former electric substation are identified as Block 16166 Lot 155 and the majority of Lot 110 on the Queens Tax Map (herein referred to as the "On-Site Property"). The On-Site Property is an approximately 8.9-acre area and is bounded by Beach Channel Drive to the north, Rockaway Freeway to the south, Beach 108th Street to the east, and Rockaway Freeway to the west (see **Figure 2**).

The bulkhead area, which was historically used for off-loading of coal for the former MGP Site, is located the North of the On-Site Property. This property, located north of Beach Channel Drive between Rockaway Freeway and Beach 108th Street is identified as Block 16166 Lot 177 on the Queens Tax Map (herein referred to as the "Off-Site Property"). The Off-Site Property is an approximately 1.0-acre area and is bounded by Jamaica Bay to the north, and Beach Channel Drive to the south. National Grid does not own the Off-Site Property. Refer to section 2.1.2 for Off-Site Property location, description and owner information.

Both the On-Site Property and Off-Site Property are governed under this SMP.

KeySpan Gas East Corporation d/b/a National Grid (hereinafter "National Grid" or "RP") entered into an Order on Consent on March 31, 1999 with the NYSDEC to remediate MGP-related impacts at the Site. The Order on Consent required the RP to investigate and remediate MGP-related impacts from the former MGP facility at the Site. A figure showing the Site location and boundaries of this Site is 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 National Grid, the owner of the Site (the "Grantor"), to the NYSDEC, and shall be recorded at the County Clerk by the RP or the NYSDEC. Activities on the Off-Site Property will be governed under a Memorandum of Understanding (MOU) between National Grid and the property owner. There is no Environmental Easement for the Off-Site Property.

After completion of the remedial work, some MGP-related impacts were left in the subsurface at this Site. The remaining MGP-related impacts are generally located in the deeper soils at the Site and do not have the potential for day-to-day exposure to the public. Institutional and Engineering Controls (ICs and ECs) have been incorporated into the Site remedy to control exposure to remaining subsurface impacts to ensure protection of public health and the environment. An Environmental Easement for the On-Site Property granted to the NYSDEC, and recorded with the NYC Department of Finance, Office of the City Register, requires compliance with this SMP and all ECs and ICs placed on the Site. The MOU between National Grid and the Off-Site Property owner requires compliance with compliance with the SMP.

The ECs to be established on the On-Site Property as part of the remedy include a Soil Cover System. ICs consist of an Environmental Easement, placing restrictions on site use, and maintenance, monitoring and reporting measures for all Engineering Controls and Institutional Controls. Post-remedial groundwater monitoring and sampling to determine the success of the remedy will be conducted as well as periodic inspections of the Site to assess compliance with the provisions of this SMP.

ECs and ICs will also be incorporated into the remedy for the Off-Site Property to control exposure to remaining MGP-related impacts to ensure protection of public health and the environment. The Off-Site Property owner shall not interfere with the Composite Cover System on the Off-Site Property.

The ECs on the Off-Site Property include a Composite Cover System. The Off-Site Property will be subject to similar post-remedial monitoring as described above for the On-Site Property with regard to the On-Site Soil Cover System. The RP (National Grid) shall replace and/or repair the Composite Cover System on the Off-Site Property removed or damaged after the completion of the remedy. The Off-Site Property Owner will be responsible to maintain the Composite Cover System to address normal wear and tear and shall replace the Composite Cover System if disturbed during activities conducted on the Off-Site Property (e.g., utility installation).

This SMP was prepared to manage remaining impacts at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36 and National Grid is released from the MOU. This plan has been approved by the NYSDEC, and compliance with this plan is required by the Grantor of the Environmental Easement and the Grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the Site-specific implementation procedures that are required by the Environmental Easement and MOU. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the Order on Consent (Index # D1-0002-98-11; Site #2-41-029) for the Site, and thereby subject to applicable penalties.

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

This SMP was prepared by 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. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

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, upgrades to or shut-down of a remedial system, post-remedial removal of MGP-related impacted sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the On-Site Property, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

1.3.1 On-Site Property Notification Requirements

All intrusive activities must be approved by NYSDEC. Sufficient notification must be made to NYSDEC so they can make the decision on the type of reporting. Typically, the type of notification and reporting requirements depend on the scope of work. Large scale intrusive work may require a detailed work plan, such as a Remedial Action Work Plan while smaller scale intrusive activities may require a Notice of Intrusion letter or a simple letter work plan.

Notifications will be submitted by the 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 the terms of the Order on Consent, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 30-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Once National Grid is made aware, notice will be provided to NYSDEC within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Once National Grid is made aware, notice will be provided to NYSDEC via verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any proposed change in the ownership of the On-Site Property or Off-Site Property, use of the On-Site Property or Off-Site Property, or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC and National Grid (if not the property owner) 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 all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the On-Site Property or Off-Site Property, the new owner's name, contact representative, and contact

information will be confirmed in writing to the NYSDEC and National Grid (if not the property owner).

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

Table 1A: Notifications*

Name	**Contact Information**
Sydney Sobol, NYSDEC Project Manager	(518) 402-4799 Sydney.sobol@dec.ny.gov
Bureau of Environmental Exposure Investigation, New York State Department of Health (NYSDOH)	(518) 402-7860 BEEI@health.ny.gov

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

1.3.2 Off-Site Property Notification Requirements

Notifications will be submitted by the Off-Site Property owner to National Grid, as needed, for the following reasons:

- 60-day advance notice of any proposed changes in the use of the Off-Site Property.
- 45-day advance notice of any proposed ground-intrusive activity to be conducted on the Off-Site Property pursuant to the Excavation Work Plan.
- Once National Grid is made aware, notice will be provided by National Grid to NYSDEC within 48-hours of any damage or defect to the Composite Cover System on the Off-Site Property 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, notice will be provided by National Grid to NYSDEC by verbal notice by noon of the following day of any emergency, such as a fire, flood or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Off-Site Property, with written confirmation

by National Grid within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

- National Grid will submit follow-up status reports on actions taken to respond to any emergency event on the Off-Site property requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs on the Off-Site property.

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

- At least 60 days prior to the change, National Grid will be notified in writing of the proposed change. This will include a certification that the prospective purchaser has been provided with a copy of this SMP.

- Within 15 days after the transfer of all or part of the Off-Site Property, the new owner's name, contact representative, and contact information will be confirmed in writing to National Grid.

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

Table 1B: Off-Site Property Notifications*

Name	Contact Information
Kylie Murphy, Off-Site Property Representative, New York City Department of Parks & Recreation	718-760-6853 kylie.murphy@parks.nyc.gov

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

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

2.1.1 On-Site Property Location and Description

The On-Site Property is located in Rockaway Park, Queens County, New York and is identified as Block 16166 Lot 155 and the majority of Lot 110 on the Queens Tax Map. The On-Site Property is an approximately 8.9-acre area and is bounded by Beach Channel Drive to the north, Rockaway Freeway to the south, Beach 108th Street to the east, and Rockaway Freeway to the west (see **Figure 2**). The boundaries of the On-Site Property are more fully described in **Appendix A** – Environmental Easement.

National Grid is currently the owner of the two lots which comprise the On-Site Property. Both Lot 155 and the portion of Lot 110 that are included in the On-Site Property area are zoned as manufacturing (M2-1) and are currently vacant. An active electric substation is located in the northwest corner of Lot 110. This portion of the parcel is not included as part of the former MGP Site. National Grid submitted a Delisting Petition in August 2000 to remove the active substation from the Site. In October 2000, the NYSDEC approved reclassifying the active substation portion of the Site on the Registry of Inactive Hazardous Waste Disposal Sites.

2.1.2 Off-Site Property Location and Description

The Off-Site Property is located in Rockaway Park, Queens County, New York and is identified as Block 16166 Lot 177 on the Queens Tax Map. The Off-Site Property is an approximately 1.0-acre area and is bounded by Jamaica Bay to the north, and Beach Channel Drive to the south (see **Figure 2**). The owner of the Off-Site Property at the time of issuance of this SMP is the NYC DPR and the parcel is currently a public park. The property is currently zoned as manufacturing (M1-1). A metes and bounds survey of the Off-Site Property is included in **Appendix C**.

2.1.3 Off-Site Adjacent Street Locations and Description

During the RI and subsequent annual groundwater sampling, soil and groundwater impacts were observed below portions of the adjacent streets. The portions of Beach 108th Street and Beach Channel Drive identified on Figure 2 are subject to provisions of this SMP. The limits of the impacts in these areas are described below .

Beach 108th Street Between Rockaway Freeway and Beach Channel Drive

- Soil impacts in this area limited to low levels of individual PAHs compounds from 10-12 feet below ground surface.
- Groundwater impacts exceeding the New York State Ambient Water Quality Standards in this area are limited to individual BTEX compounds, isopropylbenzene and 4-Chloroaniline in the shallow groundwater interval at MW-17S and individual BTEX compounds and isopropylbenzene in the intermediate groundwater level at MW-17I.

Beach Channel Drive Between Beach 108th Street and the eastern edge of the Rockaway Beach Substation.

- Soil impacts in this area limited to the area between the two subsurface barrier walls at depth.
- Groundwater impacts exceeding the New York State Ambient Water Quality Standards in this area are limited to individual PAHs and BTEX compounds primarily in the shallow and intermediate groundwater intervals and low levels of PAHs in the deeper groundwater between the two subsurface barrier walls. The highest detections of BTEX and Naphthalene are present at monitoring well RPMW-11I where methyl tert-butyl ether (MTBE) was also detected in the intermediate groundwater interval. MTBE is not an MGP-related contaminant.

2.2 Physical Setting

2.2.1 Site History/Land Use

The Rockaway MGP began operations in the late 1870s. The plant was operated by Rockaway Electric Light Co., Town of Hempstead Gas & Electric Company, and later the Queensboro Gas and Electric Company from the late 1870s to 1926. In 1926, Queensboro Gas and Electric Company became a subsidiary of the Long Island Lighting

Company (LILCO). LILCO operated the plant from 1926 to approximately 1958, when most of the facilities were demolished. In 1998, KeySpan Corporation acquired the former MGP property through a merger of LILCO and Brooklyn Union Gas Company.

In 1894, the plant consisted of two gas holders, a generator, purifiers and scrubbers. The records indicate that the MGP operated carbureted water gas and coal carbonization processes during early gas production. After 1905, the carbureted water gas process was the only process used during gas production. In 1912, the MGP expanded to the north and east and a portion of the southern property boundary was located beneath the present Rockaway Freeway. The plant now included a half-million cubic foot gas holder, several oxide tanks, generator and boiler buildings, engine room, several oil tanks, and a condenser.

The plant expanded in the mid-1920s to a strip of land to the north of the existing plant. This land was created when Jamaica Bay was filled in during Beach Channel Drive Construction. In 1933, the plant figuration included several additional structures that could allow increased gasification, tar and oil separation and storage, and coke and gas storage. These structures included a 2-million cubic foot gas holder, drip oil tanks, skimming basin, condensers, oxide enclosure, generator ash storage bin, tar separator, tar settling and drying tanks, and tar de-emulsifier. The MGP ceased operations in 1957 and was demolished in 1958.

Five industrial supply wells were formerly located on the MGP property. A mixture of clay, liquid mud, and cement were used to abandon these wells. Three of the wells were abandoned in the 1930s and the abandonment dates of the other two wells are not known.

In October 2000, the NYSDEC approved the National Grid's request to reclassify the northwestern portion of the Rockaway Park former MGP site on the Registry of Inactive Hazardous Waste Disposal Sites. This portion of the Site is the current active substation. It was delisted based on investigation results and a risk assessment, which

concluded that the construction worker subsurface-soil exposure in the proposed substation area did not pose an unacceptable carcinogenic health threat or non-cancer health hazard.

A remediation was completed at the On-Site Property between 2008 and 2012. A subsurface barrier wall was installed to depths of 50 and 120 feet below ground surface (ft bgs) and impacted soil within the upper eight feet was removed and transported off site for thermal treatment. An On-Site Soil Cover System was installed across the Site consisting of a demarcation barrier, 18-inches of sand backfill, and 6-inches of gravel fill. Twenty-six passive Dense Non-Aqueous Phase Liquid (DNAPL) recovery wells were installed on the On-Site Property to monitor the presence of DNAPL and remove accumulated DNAPL as necessary.

In November 2012, an approximately 68,000 square foot area in the northeast corner of the Site was converted into a parking area for local commuters using a temporary ferry service during Hurricane Sandy repairs to the rail system. The gravel portion of the On-Site Soil Cover System in this area was removed, stockpiles in berms, and replaced with recycled concrete aggregate to form a stable parking surface for commuter vehicles.

A remediation was completed at the Off-Site Property between 2015 and 2016. A subsurface barrier wall was installed to depths of 60 to 70 ft bgs and impacted soil within the upper 2 feet was removed and transported off-site for thermal treatment. An Off-Site Composite Cover System was installed across the Off-Site property consisting of a demarcation barrier and either a minimum of 6-inches of clean backfill covered with either 10.5-inches of asphalt cover or 5-inches of concrete cover or 2 feet of planting soil mix. Fourteen passive DNAPL recovery wells were installed on the Off-Site Property to monitor the presence of DNAPL and remove accumulated DNAPL as necessary.

The properties adjoining the Site and in the neighborhood surrounding the Site primarily include commercial, industrial, and residential properties. The properties south of the Site include residential properties located south of Rockaway Beach Freeway and the MTA rail lines; Jamaica Bay is north of the Site; the properties immediately east of the

Site include the New York City Department of Environmental Protection waste water treatment plant property; and the properties to the west of the Site include commercial properties including a shopping center and retail gasoline station.

2.2.2 Geology

This section was based on information presented in the Dvirka and Bartilucci (D&B) Remedial Investigation (RI) Report for the Rockaway Park Former MGP Site as presented in the GEI Final RI.

2.2.2.1 Regional Geology

The Site is located within the Atlantic Coastal Plain geomorphic province. There are approximately 980 feet of unconsolidated deposits overlying bedrock at the former MGP Site. The deposits underneath generally consist of outwash deposits comprised of gravel and sand with lenses of finer materials. Recent deposits consisting of artificial fill, peat, shell bearing mud, silt, clay, wind- and wave- deposited sands, gravels, and shell fragments overlie the outwash deposits.

2.2.2.2 Site-Specific Geology

Three major stratigraphic units were identified during the Remedial Investigation (RI) and Final RI drilling program:

- Recent/post glacial fill
- Barrier island deposits
- Glacial outwash deposits

A general description of the three stratigraphic units is provided below.

Fill Material

Fill material is distributed throughout the site investigation areas and was placed in a series of land area expansions from approximately the 1800s to the 1930s. The Sanborn

Fire Insurance maps indicate that approximately the northern two-thirds of the site investigation areas were part of Jamaica Bay in 1894. Retaining wall remnants are still present at the Site and mark former bulkheads that supported these filling activities.

Fill material observed at the Site consisted primarily of sand with minor amounts of finer and coarser material. The fill material also includes variable amounts of coal, tar coke, clinkers, slag wood, concrete, brick, ash, glass, and crushed shell fragments. Fill materials were encountered to approximately 10 to 15 ft bgs in most of the Site areas. Fill was observed to approximately 30 ft bgs in the bulkhead area.

Barrier Island Deposits

Underlying the fill unit throughout much of the Site are sandy, shell-bearing deposits interpreted as recent near-shore, beach, and dune deposits. These are identified as the barrier island deposits. The barrier island deposits contain minor amounts of silt and clay lenses. In addition, shell-bearing layers ranging from approximately 2 feet to 29 feet thick were observed. These layers sometimes contained coarser sand and gravels. The barrier island deposits were observed through the depths of most borings in the site investigation areas. The deposits are approximately 55 to 70 feet thick throughout the Site.

Underlying the barrier island deposits at approximately 55 to 70 ft bgs, a distinct color change was observed from gray to brown in borings located throughout the Site. This was interpreted as a transition between the barrier island deposits and the glacial outwash deposits. The transitional zone is approximately 35 to 40 feet thick. Also, a silty sand layer was observed between 65 and 95 ft bgs in this transitional layer.

Glacial Deposits

Underneath the transitional zone, glacial deposits consisting of primarily well-sorted brown outwash sands were encountered. The glacial deposits were encountered at approximately 95 to 105 ft bgs. Some silty sand lenses were observed in the borings at approximately 100 ft bgs in some of the borings.

A geologic cross section is shown in **Figure 3**. Site-specific boring logs are provided in **Appendix D**.

2.2.3 Hydrogeology

2.2.3.1 Regional Hydrogeology

There are four major aquifers in the Rockaway peninsula identified as the Jameco, Lloyd, Magothy, and Upper Glacial aquifers. Regional hydrogeology of the Rockaway peninsula is characterized by groundwater flow north towards Jamaica Bay within the northern portions of the Peninsula and south towards the Atlantic Ocean in the southern portions. Regional hydraulic conductivities calculated within the outwash deposits underlying the Site area average approximately 270 feet per day for horizontal flow and 27 feet per day for vertical flow. The water table is near or below sea level in the vicinity of the Site. Water table conditions are encountered on Rockaway peninsula within the outwash deposits.

2.2.3.2 Site-Specific Hydrogeology

There is one shallow, unconfined aquifer beneath the Site. Wells were installed at consistent, yet arbitrary, depth intervals in order to evaluate different groundwater zones of the aquifer during the RI. The zones selected are identified as follows: shallow "S" (wells screened at the water table ranging from 2 to 17 feet ft bgs), intermediate "I" (wells screened from 17 to 45 ft bgs), deep "D" (wells screened from 45 to 90 ft bgs), and deep (2) "D2" (wells screened from 90 to 105 ft bgs). Groundwater depths were collected from all accessible monitoring wells at low and high tides based on the survey tidal mark and tide charts obtained from the National Oceanic and Atmospheric Administration. The water table was observed at approximately 8 ft bgs during monitoring events at the Site.

Three tidal studies have been conducted to confirm the groundwater flow at and adjacent to the Site. In general, groundwater at low tide on the eastern portion of the Site flows northeast towards Jamaica Bay, and shallow groundwater on the western portion of

the Site flows northwest towards Jamaica Bay. At high tide, the shallow groundwater contour map depicts the presence of a groundwater divide (or trough) on the Site from the former location of PZ-06 on the southwest corner to the former location of MW-02 on the eastern edge of the Site. This trough is the result of high tidal levels within Jamaica Bay causing shallow groundwater to flow southerly toward the Site during high tide. However, this effect does not "over-ride" the dominant shallow discharge pattern toward Jamaica Bay across the entire Site, thus creating a localized trough. South of the trough, the shallow groundwater still flows north toward Jamaica Bay, even during high tide.

A groundwater contour map depicting the conditions during the October 2016 groundwater sampling event is shown in **Figure 4**. Groundwater elevation data from the October 2016 groundwater sampling event is provided in **Table 2**. Groundwater monitoring well construction logs are provided in **Appendix D**.

2.3 Remedial Investigation

The following narrative provides a brief summary of the available project records to document key investigative and remedial milestones for the Site.

A Remedial Investigation was performed to characterize the nature and extent of MGP-related impacts at the Site. The results of the RI are described in detail in the following reports:

- D&B, 2002, *Remedial Investigation Report, Rockaway Park Former Manufactured Gas Plant Site.* October 24, 2002.
- GEI Consultants, Inc., 2004, *Final Remedial Investigation Report, Rockaway Park Former Manufactured Gas Plant Site, Rockaway Park, New York*. January 30, 2004.
- GEI Consultants, Inc., 2004. *Supplemental Groundwater Investigation, Report Rockaway Park Former Manufactured Gas Plant (MGP) Site*. March 15, 2004.
- GEI Consultants, Inc., 2004. *Supplemental Sediment Investigation, Report Rockaway Park Former Manufactured Gas Plant (MGP) Site*. April 20, 2004.

Additional Pre-Design Investigations were conducted in 2008 to confirm the impacts observed in the upper 8 feet of Site during the RI. The results of the additional investigations were used to finalize the extent of the remedial excavation at the Site and are included in the following report:

- Paulus, Sokolowski and Sartor Engineering, PC, 2008, *100% Submission Remedial Design Report, Rockaway Park Former Manufactured Gas Plant Site, Rockaway Park, Queens County, New York, Site Number 2-41-029.* November 7, 2008.

In summary, the RI determined that MGP related impacts were observed in surface soil, subsurface soil, and groundwater at the Site. These impacts included non-aqueous phase liquid (NAPL) source material as well as concentrations of benzene, toluene, ethylbenzene, and xylene (BTEX) compounds, polycyclic aromatic hydrocarbons (PAHs), and cyanide above the soil clean up objectives and groundwater standards. Within the active substation, MGP related impacts are limited to groundwater. Potential human exposure to these MGP-related impacts present in the media at the Site requires mitigation via remedial action. There are no potential ecological exposures of significance. The potential exposure to groundwater is only anticipated to occur through infrequent ground intrusive construction-related activities.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Proposed Remedial Action Plan dated August 2004 are as follows:

- Eliminate or reduce, to the extent practicable:
    - exposures of persons at or around the Site to PAHs, benzene, toluene, ethylbenzene, and BTEX, and cyanide in soil, groundwater, and soil gas vapors;
    - environmental exposures of flora or fauna to PAHs, BTEX, and cyanide in soil, groundwater, soil gas vapors, and sediment;
    - the release of contaminants from soil into groundwater that may create exceedances of groundwater quality standards; and

- the release of contaminants from surface soil, subsurface soil, soil gas vapors, groundwater, and sediment into surface water, indoor air, ambient air, sediment, and soil gas vapors through storm water erosion, vaporization, wind borne dust, and groundwater discharge.

- Attain, to the extent possible:
  - Ambient groundwater quality standards; and
  - Recommended soil cleanup values for surface soils.

2.5 Remedial History

The Site was remediated in accordance with the NYSDEC-approved 100% Remedial Design Report dated December 2008, the NYSDEC-approved Field Change Requests, and the NYSDEC-approved DNAPL Gauging and Recovery Rate Analysis Work Plan dated September 2012.

The following is a summary of the Remedial Actions performed at the Site:

- A shallow excavation was completed to the approximate depth of the water table at 8-feet below grade at the Site. Outside of the shallow excavation limits, the upper two feet of material was removed to accommodate the installation of the On-Site Soil Cover System. The limits of both excavations are depicted in Figure 5. Approximately 165,292 tons of material was excavated and disposed of off-site.

- A composite DNAPL migration barrier was constructed at the Site to contain impacted materials at the Site. The composite DNAPL migration barrier was constructed in accordance with the remedial design plan and specifications and the NYSDEC-approved Field Change Request # 6a and the Phase 3: Composite 120-Foot-Deep DNAPL Migration Barrier Installation Procedures, both dated July 2010.

- The location of composite On-Site DNAPL migration barrier is depicted in Figure 6 and consists of the following components:
  - A 695-foot long Waterloo Barrier® sheet pile barrier was installed. The Waterloo Barrier® sheet piling were installed to depths of 50-feet on the flanks and 60 feet in the center of the wall.
  - Soil-cement jet grout columns were installed to a depth of approximately 120 ft bgs with a continuous 5-foot wall overlap with the 250-foot long center section of the Waterloo Barrier® sheet piles.

- The location of composite Off-Site DNAPL migration barrier is depicted in Figure 6 and consists of a 137-foot long Waterloo Barrier® sheet pile barrier was installed. The Waterloo Barrier® sheet piling were installed to depths of 60 to 70 feet bgs.

- A Cover System was installed on both the On-Site and Off-Site Properties.

    - The On-Site Soil Cover System consists of an 18-inch layer of well graded sandy soil material overlain with 6 inches of 2.5-inch crushed stone and underlain with a fabric demarcation barrier between the On-Site Soil Cover System and the subgrade materials. The location of the On-Site Soil Cover System is depicted in **Figure 6**.

    - The Off-Site Composite Cover System consists of either a 24-inch layer of clean fill meeting the Restricted Residential Use SCOs underlain with a fabric demarcation barrier between the Composite Cover System and the subgrade materials or an asphalt/concrete surface, underlain with 6-inches of clean fill and a fabric demarcation barrier. The location of the Off-Site Composite Cover System is depicted in **Figure 6**.

- Forty-one passive DNAPL recovery wells were installed. One of the recovery wells was destroyed in 2015 and was not replaced with approval from the NYSDEC. The locations of the remaining 40 recovery wells are depicted in **Figure 7**.

2.6 MGP-Related Impacts

2.6.1 Soil

PAHs, cyanide, and metals were identified as compounds of concern (COCs) in surface soil. These compounds were detected throughout the Site with higher concentrations in the vicinity of some of the former MGP structures. The surface of the Site was primarily grass covered with some areas covered by gravel, asphalt, structures, and sparsely vegetated areas. Migration of MGP-related impacts from the surface soil was possible at the Site, but primarily through the transport of particulates. The nature of the COCs identified during the RI was such that they were relatively persistent in soils and would likely remain attached to soil particulates.

BTEX, PAHs, and metals, were identified as COCs in subsurface soil to depths of approximately 120 feet below grade in the area of the former gas works. In general, the distribution of BTEX and PAHs in soil coincides with the presence of DNAPL as depicted

on **Figure 8**. BTEX constituents in subsurface soils not associated with DNAPL are typically mobile and not particularly persistent in the surrounding environment due to their high volatility, low adsorption to soils, and high water solubility. With few exceptions, the PAHs associated with the Site are relatively persistent in the soil matrix and associated with DNAPL. This is primarily due to their generally low water solubility and high sorption to soils. Metals in soil are also anticipated to be relatively persistent.

The physical and chemical distribution of MGP-related impacts at the Rockaway former MGP prior to remediation indicated the presence of four separate source areas of tar-saturated material in the subsurface soils. The four source areas were identified in the RI as:

- The former tar separators and holders in the Former Gas Works Area
- The former skimming basin in the Former Gas Works Area
- The depositional tar saturated material in the Former Electric Substation Area
- The former drip tanks located in the Former 2 Million CF Holder and Drip Tank Area

These source areas were defined by significant zones of tar-saturation and the presence of DNAPL and light non-aqueous phase liquid (LNAPL), which coincide with the highest concentrations of PAHs and BTEX recorded in the subsurface and groundwater. The areal extent of NAPL impacts is depicted on **Figure 8,** the figure is a depth-integrated composite of the broadest observed lateral extent of visually identifiable NAPL related impacts, including tar saturation, and blebs, sheens and staining from the RI.

Free tar has not been observed within the bulkhead area. The NAPL-related impacts observed there are limited to sheens, blebs and staining.

Tables 3A, **Table 3B**, and **Table 3C** summarize the results of all soil samples collected that represent soils left in place after completion of the remedial action and exceed the Unrestricted Use SCOs, the Restricted Residential Use SCOs, the Commercial Use

SCOs, and the Industrial Use SCOs for the On-Site Property (**Table 3A**), the Off-Site Property (**Table 3B**), and the adjacent properties (**Table 3C**) after completion of remedial action.

2.6.2 Sediment

Sediments containing MGP related materials are present in the shallow sediments in a limited area on the waterside of the bulkhead adjacent to the Site. Based upon the visual observations and the analytical results from the RI, the impacts encompass an approximately 80-ft by 25-ft area adjacent to the bulkhead and do not appear to extend further than 30 feet offshore. There does not appear to be any lateral migration of tar from the subsurface soil on the landside of the Site to the sediments. The MGP related materials observed were limited to the shallow sediments in a defined area.

Table 4 summarizes the results of all sediment samples collected that exceed the SCGs after completion of the remedial action. The sediment locations collected adjacent to the bulkhead area are depicted on **Figure 8**.

2.6.3 Groundwater

BTEX, PAHs, and cyanide have been identified as COCs in groundwater. The significant tidal influence on Site groundwater has had a significant effect on limiting the migration of dissolved phase impacts off-site. The inversion that occurs at high tide creates ebb and flow of groundwater over the impacted areas and limits the migration of dissolved phase impacts off-site. This effect decreases with depth and has limited effect on the deep groundwater zone, **Figure 9** depicts the extent of groundwater impacts from the RI. The figure is a depth-integrated composite of the broadest observed lateral extent of groundwater impacts from the RI.

Concentrations of MGP-related impacts in groundwater within the area of DNAPL impacts are likely in a steady state condition, where the rate of dilution from inflowing clean water equals the rate of dissolution of MGP-related impacts from the DNAPL. The

likely age of the release (greater than 40 years) would have allowed the groundwater system on the Site to reach steady state. The groundwater plume extends to the well clusters located near the bulkhead area.

2.6.4 Soil Vapor

Twenty-five soil vapor samples were collected across the Site and analyzed for BTEX compounds and naphthalene. Naphthalene was not detected in any of the samples. At least one BTEX compound was detected in each sample; the most common detection was toluene. The highest concentration of BTEX detected on-site was 1800 micrograms per Liter. The next highest concentration of BTEX compounds was upgradient of the Site.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

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

This plan provides:

- A description of all IC/ECs on the Site;
- The basic implementation and intended role of each IC/EC;
- A description of the On-Site Property key components of the ICs set forth in the Environmental Easement;
- A description of the Off-Site Property key components of the ICs set forth in the MOU;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in **Appendix E**) for the proper handling of remaining impacted material that may be disturbed during maintenance or redevelopment work on the On-Site Property and the Off-Site Property;
- A description of the roles and responsibilities of each party with respect to this SMP; 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

3.2.1 On-Site Property Institutional Controls

A series of ICs is required by the Record of Decision (ROD) to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to MGP-related impacts; and, (3) limit the use and development of the Site to restricted residential, commercial or industrial uses, subject to approval by the appropriate agencies. Adherence to these ICs on the Site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on **Figure 6**. These ICs are:

- Compliance with the Environmental Easement and this SMP by the Grantor and the Grantor's successors and assigns;
- The On-Site Property may only be used for commercial or industrial uses provided that the long-term Engineering and Institutional Controls included in this SMP are employed.
- The On-Site Property may not be used for a higher level of use, such as unrestricted or residential use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC.
- All ECs must be operated and maintained by National Grid as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the New York City Department of Health and Mental Hygiene to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Groundwater monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management of the must be reported at the annually by National Grid. The details on the certification are provided in Section 7.

- All future intrusive activities on the On-Site Property that will disturb remaining MGP-related impacts must be conducted in accordance with this SMP.

- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;

- The potential for vapor intrusion must be evaluated for any buildings developed on the On-Site Property and the installation of sub-slab depressurization systems or other mitigation may be required;

- Access to the On-Site Property 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; and,

- Vegetable gardens and farming on the property are prohibited.

National Grid will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the On-Site Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such On-Site Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

3.2.2 Off-Site Property Institutional Controls

ICs will be implemented after completion of the remedy at the Off-Site Property, which are agreed to in an MOU between National Grid and the owner of the Off-Site Property. The ICs include: (1) implement, maintain and monitor EC systems; (2) prevent future exposure to remaining MGP-related impacts; and, (3) limit the use and development of the Off-Site Property to restricted residential, commercial or industrial uses. The IC boundaries are shown on **Figure 6**. These ICs are:

- The Off-Site Property may be used for: restricted residential use;
- ECs must be operated and maintained by the Owner through notification to National Grid as specified in this SMP;
- National Grid will inspect at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the Off-Site Property will be prohibited without prior approval of National Grid in order to ensure it is safe for use as drinking water or for industrial purposes. The owner of the Off-Site Property must first notify National Grid and obtain written approval to do so from the National Grid;
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to management of the Off-Site Property must be reported to National Grid at the frequency and in a manner as defined in this SMP;
- The Owner of the Off-Site Property must notify National Grid prior to future intrusive activities that will disturb remaining MGP-related impacted material. The invasive activities must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the Off-Site property must be provided to National Grid with reasonable prior notice to the owner of the Off-Site Property to assess compliance with the restrictions identified by the MOU.
- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted on Figure 6, and any potential impacts that are identified must be monitored or mitigated; and,
- Vegetable gardens and farming on the Off-Site Property are prohibited.

3.3 Engineering Controls

3.3.1 On-Site Soil Cover System

Exposure to remaining MGP-related impacts in soil/fill at the On-Site Property is prevented by an On-Site Soil Cover System. This On-Site Soil Cover System is comprised of a Marafi 135N geotextile placed over the compacted subgrade and native materials, a minimum of 18 inches of clean well-graded sandy soil, and 6-inches of 2.5-inch crushed stone. **Figure 6** presents the location of the cover system and applicable demarcation layers. The Excavation Work Plan that appears in **Appendix E** outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, such that its structural integrity is compromised, and any underlying remaining MGP-related impacts are disturbed. Transport of materials removed during work below the On-Site Soil Cover System from the On-Site Property will follow the designated truck routes identified in the EWP and the depicted in **Figure 10**.

Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the On-Site Property and provided in **Appendices I and J**.

The On-Site Soil Cover System is a passive Engineering Control and no operation of the control is required. The quality and integrity of the system will be ensured by the use of Institutional Controls, as discussed in section 4.2.

3.3.2 Off-Site Composite Cover System

Exposure to MGP-related impacts in soil/fill at the Off-Site property at the Site is prevented by a composite cover system placed over the Off-Site property. This composite cover system is comprised of a minimum of a demarcation layer and a minimum of six inches of clean fill, asphalt pavement, and concrete pads. Additionally, on the majority of

the property, the composite cover system comprises of a minimum of 2 feet of certified clean fill that meets the requirements of the 6 NYCRR 375 Restricted Residential SCOs. The Excavation Work Plan (EWP) provided in **Appendix E** outlines the procedures required to be implemented in the event the cover system is breached, penetrated or temporarily removed, such that its structural integrity is compromised, and any underlying remaining MGP-related impacts are disturbed. Transport of materials removed during work below the Composite Soil Cover System from the Off-Site property will follow the designated truck routes identified in the EWP and the depicted in **Figure 10**.

Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the Site and provided in **Appendices I and J.**

The Off-Site Composite Cover System is a passive Engineering Control and no operation of the control is required. The quality and integrity of the system will be ensured by the use of Institutional Controls, as discussed in section 4.2.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy on both the On-Site Property and Off-Site Property. National Grid, as the RP (Respondent), maintains responsibility for implementing the requirements of the Monitoring and Sampling Plan. The owner of the Off-Site Property maintains the notification requirements included in this SMP. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the Site are included in the Quality Assurance Project Plan provided in **Appendix F**.

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

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

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;
- Reporting requirements;
- Monitoring well decommissioning procedures; and
- Annual inspection and periodic certification.

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Cover System Inspections

Cover System inspections will be performed on both the On-Site Property and Off-Site Property by National Grid's Qualified Environmental Professional annually. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Cover System inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in **Appendix G** – Site Management Forms. The form will compile sufficient information to assess the following:

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

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed on the On-Site Property and Off-Site Property in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen

failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the On-Site Property or the Off-Site Property. Once National Grid is notified, verbal notice to the NYSDEC must be given by noon of the following day, to the extent possible. In addition, an inspection of the On-Site Property and the Off-Site Property will be conducted within 5 days of the event (to the extent possible) to verify the effectiveness of the IC/ECs implemented at the Site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event (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. This confirmation will be made by National Grid.

4.3 Post-Remediation Media Monitoring and Sampling

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

Table 5 – Post Remediation Sampling Requirements and Schedule

Sampling Location	**Analytical Parameters**				**Schedule**
	VOCs (EPA Method 8260B)	SVOCs (EPA Method 8270C)	Total Cyanide (EPA Method 9012B)	Free Cyanide (EPA Method 9016)	
Groundwater Monitoring Wells	X	X	X	X	Annually

Detailed sample collection and analytical procedures and protocols are provided in **Appendix H** – Field Sampling Plan and **Appendix F** – Quality Assurance Project Plan. The specific schedule of sampling and analysis for each monitoring well is included on **Table 6**.

4.3.1 Groundwater Sampling

Groundwater monitoring will be performed on an annual basis to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

The network of monitoring wells has been installed to monitor upgradient, on-site and downgradient groundwater conditions at the Site. The majority of the on-site monitoring wells were decommissioned during the Remedial Action to accommodate the shallow excavation and installation of the On-Site Soil Cover System. The monitoring wells remaining on-site represent conditions at the South and West site boundaries beyond the extent of the shallow excavation. In addition, off-site monitoring wells located on Beach Channel Drive to the North and Beach 108th Street provide boundary conditions to the North and East of the Site.

Table 6 summarizes the wells identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells.

The locations of the monitoring wells and recovery wells are depicted on **Figure 7**. Monitoring well construction logs are included in **Appendix D** of this document.

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped by National Grid's Qualified Environmental Professional. Additionally, monitoring wells will be properly decommissioned and replaced by National Grid's Qualified Environmental Professional, 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 Qualified Environmental Professional based on assessments of structural integrity and overall performance.

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

In April 2021, National Grid received approval from NYSDEC to amend the post remedy groundwater sampling program. Several wells at the Site had not exhibited groundwater impacts or exhibited measurable DNAPL over a 5-year monitoring period. Six of the existing monitoring wells had met the NYSAWQS for BTEX and PAHs during previous sampling events. In three recovery wells no DNAPL had been observed during the monitoring period. These monitoring and recovery wells have been abandoned and removed from the Site's monitoring program. In addition, two monitoring wells were abandoned and relocated to accommodate construction staging and potential future Site redevelopment.

Monitoring wells removed from the sampling program will not be immediately abandoned and therefore may be reintroduced into the sampling program if Site conditions change. Monitoring wells that have been removed from the program will be abandoned no sooner than 1 year following removal from the program. Recommendations for monitoring well abandonments will be submitted to the NYSDEC prior to abandonment.

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

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

4.3.2 DNAPL Monitoring and Recovery

The thickness of DNAPL, if present, will be measured in each DNAPL recovery well using an electronic interface probe (probe). The probe will be used to record the depth to water, the depth to DNAPL, and then the depth to bottom of each DNAPL recovery well sump. The baseline thickness of DNAPL prior to removal will be calculated by subtracting the depth to the DNAPL from the depth to bottom of the DNAPL recovery well. An estimate of the volume of DNAPL will be generated for each DNAPL recovery well.

Recovery wells exhibiting measurable quantities of DNAPL will be bailed to the lowest extent possible. DNAPL removed from the wells will be containerized within the United States Department of Transportation 55-gallon drums. A sample will be collected of the recovered DNAPL for waste disposal analysis following collection of the DNAPL. The DNAPL will be transported to a National Grid-approved facility for disposal.

4.3.3 Monitoring and Sampling Protocol

All sampling activities performed by National Grid's Qualified Environmental Professional will be recorded in a field book and associated sampling log as provided in **Appendix H** – Field Sampling Plan. 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 H** of this document.

5.0 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 SMP.

6.0 REPORTING REQUIREMENTS

6.1 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 G**. These forms are subject to revision by NYSDEC for use on the On-Site Property or by National Grid for use on the Off-Site Property.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the Site and the Off-Site Property during the reporting period will be provided in electronic format to the NYSDEC by National Grid's Qualified Environmental Professional in accordance with the requirements of **Table 7** and summarized in the Periodic Review Report.

Table 7: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Periodic Review Report	Annually, or as otherwise determined by the Department

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

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

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

- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether MGP-related impacts 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^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

6.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted by National Grid's Qualified Environmental Professional to the Department beginning eighteen (18) months or other agreed upon submittal date based on required OM&M activities after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the On-Site Property or Off-Site Property is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the Site and the Off-Site Property described in **Appendix A** -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the Site.
- Results of the required annual Site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the Site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- Data summary tables and graphical representations of compounds 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 compound 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^{TM} 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 MGP-related impacts 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 the concentrations of MGP-related impacts in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.

  - The overall performance and effectiveness of the remedy.

6.2.1 Certification of Institutional and Engineering Controls

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

For the On-Site Property:

"*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;*

- *Use of the Site is compliant with the environmental easement;*

- *The engineering control systems are performing as designed and are effective;*

- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Site remedial program and generally accepted engineering practices; and*

- *The information presented in this report is accurate and complete.*

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

For the Off-Site Property:

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

- *The inspection of the Off-Site Property 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 Off-Site Property 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 Off-Site Property will continue to be provided to the Department and National Grid [if not owned by National Grid] to evaluate the remedy, including access to evaluate the continued maintenance of this control;*

- *Use of the Off-Site Property is compliant with the Memorandum of Understanding;*

- *The engineering control systems are performing as designed and are effective;*

- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the Off-Site Property remedial program [and generally accepted engineering practices]; and*

- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, [name], of [business address], am certifying as [Owner/Remedial Party or Owner's/Remedial Party's Designated Site Representative] (and if the Site consists of multiple properties): [*I have been authorized and designated by all Site owners/remedial parties to sign this certification] for the Off-Site Property."*

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

The Periodic Review Report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the Site is located and the NYSDOH

Bureau of Environmental Exposure Investigation. The Periodic Review Report may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

6.3 Corrective Measures Work Plan

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

7.0 REFERENCES

Dvirka and Bartilucci Consulting Engineers (D&B), 2000, *Substation Investigation Report and Delisting Petition, Rockaway Park Former Manufactured Gas Plant Site*. August 2000.

Dvirka and Bartilucci Consulting Engineers (D&B), 2002, *Remedial Investigation Report, Rockaway Park Former Manufactured Gas Plant Site*. October 2000.

Dvirka and Bartilucci Consulting Engineers (D&B), 2000, *Underground Feeder Cable Investigation Report, Rockaway Park Former Manufactured Gas Plant Site*. June 2002.

Foster Wheeler Environmental Corporation, 2002. *New Substation Construction Support Activities*. November 2002.

GEI Consultants, Inc., 1999, *Final Report, Interim Remedial Measure Study, Rockaway Park*
Former MGP – Substation Area. March 1999.

GEI Consultants, Inc., 2004, *Final Remedial Investigation Report, Rockaway Park Former Manufactured Gas Plant Site, Rockaway Park, New York*. January 30, 2004.

GEI Consultants, Inc., 1997, *Phase I Site Investigation Report, Rockaway Park Former MGP Site.* January 1997.

NUS Corporation, 1989. Site Inspection Report. December 1989.

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

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

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

TABLES

Table 2. Groundwater Elevation Measurements
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Monitoring Well ID	Well Diameter/Type	Screened Interval (ft bgs)	Total Depth (ft bgs)	Top of Casing Elevation (feet NAVD88)	Location	Depth To Water	Groundwater Elevation (feet NAVD88)	Time of Water Measurement
RPMW-01S	2-inch PVC	5-15	17	6.87	Beach Channel Drive	7.04	-0.17	1028
RPMW-01I	2-inch PVC	35-45	47	6.69	Beach Channel Drive	7.60	-0.91	1029
RPMW-02S	2-inch PVC	5-15	17	10.04	Beach Channel Drive	10.21	-0.17	1007
RPMW-02I	2-inch PVC	35-45	47	10.03	Beach Channel Drive	10.52	-0.49	1108
RPMW-02D	2-inch PVC	64-74	76	10.01	Beach Channel Drive	NM	NC	NC
RPMW-02D2	2-inch PVC	95-105	107	10.07	Beach Channel Drive	NM	NC	NC
RPMW-03S	2-inch PVC	5-15	17	6.22	Beach Channel Drive	6.30	-0.08	1054
RPMW-03I	2-inch PVC	35-45	47	6.41	Beach Channel Drive	7.34	-0.93	1053
RPMW-03D	2-inch PVC	65-75	77	7.12	Beach Channel Drive	7.30	-0.18	1052
RPMW-04S	2-inch PVC	5-15	17	Not Surveyed	Substation	NM	NC	NC
RPMW-04I	2-inch PVC	35-45	47	Not Surveyed	Substation	NM	NC	NC
RPMW-11S	2-inch PVC	5-15	17	8.18	Beach Channel Drive	7.21	0.97	1021
RPMW-11I	2-inch PVC	35-45	47	8.2	Beach Channel Drive	8.45	-0.25	1022
RPMW-11D	2-inch PVC	65-75	77	8.12	Beach Channel Drive	10.19	-2.07	1023
RPMW-14S	2-inch PVC	5-15	17	12.37	On-Site	11.46	0.91	1101
RPMW-14I	2-inch PVC	35-45	47	11.7	On-Site	10.82	0.88	1102
RPMW-14D	2-inch PVC	66-76	78	13.02	On-Site	11.94	1.08	1103
RPMW-14D2	2-inch PVC	95-105	107	11.61	On-Site	10.38	1.23	1103
RPMW-17S	2-inch PVC	5-15	17	6.03	Beach 108th Street	5.66	0.37	1039
RPMW-17I	2-inch PVC	35-45	47	Not Surveyed	Beach 108th Street	8.84	NC	1044
RPMW-17D	2-inch PVC	65-75	77	Not Surveyed	Beach 108th Street	5.75	NC	1145
RPMW-19S	1-inch PVC	2.3-12.3	12.3	Not Surveyed	Beach Channel Drive	6.29	NC	1138
RPMW-26S	1-inch PVC	3-13	13	Not Surveyed	Beach 108th Street	5.71	NC	1035
RW-01A	4-inch PVC	22-32	37	8.55	Beach Channel Drive	10.51	-1.96	1021
RW-01B	4-inch PVC	41-51	56	8.64	Beach Channel Drive	11.35	-2.71	1004
RW-01C	4-inch PVC	61-71	76	8.62	Beach Channel Drive	11.00	-2.38	1000
RW-02A	4-inch PVC	15-25	30	8.65	Beach Channel Drive	10.73	-2.08	1015
RW-02B	4-inch PVC	35-45	50	8.96	Beach Channel Drive	11.59	-2.63	1014
RW-02C	4-inch PVC	60-70	75	8.79	Beach Channel Drive	11.90	-3.11	1023
RW-03	4-inch PVC	15-25	30	10.2	On-Site	9.51	0.69	1032
RW-04A	4-inch PVC	30-40	45	9.98	On-Site	11.03	-1.05	1030
RW-04B	4-inch PVC	40-60	65	9.69	On-Site	10.95	-1.26	1029
RW-05A	4-inch PVC	10-20	25	9.24	On-Site	8.66	0.58	1037
RW-05B	4-inch PVC	25-40	45	9.43	On-Site	9.01	0.42	1038
RW-05C	4-inch PVC	40-50	55	9.65	On-Site	10.37	-0.72	1039
RW-06A	4-inch PVC	10-20	25	9.39	On-Site	8.66	0.73	1035
RW-06B	4-inch PVC	50-60	65	9.77	On-Site	9.41	0.36	1034
RW-07A	4-inch PVC	10-30	35	10.05	On-Site	9.07	0.98	1027
RW-07B	4-inch PVC	40-60	65	10.32	On-Site	9.89	0.43	1026
RW-08B	4-inch PVC	40-60	65	9.65	On-Site	9.24	0.41	1025
RW-09	4-inch PVC	5-30	35	10.54	On-Site	9.48	1.06	1023
RW-10	4-inch PVC	5-30	35	10.73	On-Site	9.74	0.99	1022
RW-11	4-inch PVC	20-40	45	10.88	On-Site	10.56	0.32	1020
RW-12A	4-inch PVC	20-35	40	10.67	On-Site	9.36	1.31	1017
RW-12B	4-inch PVC	35-50	55	11.1	On-Site	11.00	0.10	1019
RW-13A	4-inch PVC	5-20	25	8.75	On-Site	7.68	1.07	1042
RW-13B	4-inch PVC	55-60	65	9.04	On-Site	7.95	1.09	1043
RW-14B	4-inch PVC	10-30	35	8.62	On-Site	7.92	0.70	1045
RW-15A	4-inch PVC	40-60	65	8.87	On-Site	8.25	0.62	1049
RW-15B	4-inch PVC	80-100	105	8.69	On-Site	8.73	-0.04	1047
RW-16A	4-inch PVC	10-30	35	8.34	On-Site	7.59	0.75	1054
RW-16B	4-inch PVC	90-110	115	9.24	On-Site	7.40	1.84	1053
RW-17A	4-inch PVC	10-30	35	7.9	On-Site	7.16	0.74	1051
RW-17B	4-inch PVC	70-90	95	8.76	On-Site	2.87	5.89	1050
RW-18A	4-inch PVC	22-32	37	8.51	Beach Channel Drive	9.95	-1.44	1010
RW-18B	4-inch PVC	42-52	57	8.53	Beach Channel Drive	11.08	-2.55	1008
RW-18C	4-inch PVC	62-72	77	8.5	Beach Channel Drive	11.17	-2.67	1011
RW-19A	4-inch PVC	19-29	34	8.49	Beach Channel Drive	9.57	-1.08	1003
RW-19B	4-inch PVC	41-51	56	8.53	Beach Channel Drive	11.20	-2.67	1002
RW-19C	4-inch PVC	61-71	76	8.53	Beach Channel Drive	11.49	-2.96	1000
RW-20A	4-inch PVC	22-32	37	8.39	Beach Channel Drive	9.56	-1.17	959
RW-20B	4-inch PVC	41-51	56	8.35	Beach Channel Drive	11.02	-2.67	958
RW-20C	4-inch PVC	61-71	76	8.21	Beach Channel Drive	11.22	-3.01	957

Notes:
ft bgs - Feet below ground surface
PVC - polyvinal chloride
NAVD 88 - North American Vertical Datum 1988
All measurements were collected on October 25, 2017.
NM - Not Measured
NC - Not Calculated

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	TP-04B	B-11	B-19	B-23	MW-02	RPSB-128A	RPSB-26	RPSB-33	RPSB-40	RPSB-48	RPSB-54	B-05	RPSB-128A	RPSB-20	RPSB-20	RPSB-25	RPSB-26	RPSB-32	RPSB-32	RPSB-39	RPSB-39	RPSB-40
						Sample Name	RPTP-4 (8.5-9.0)	RB-112398-B1	RB-111998-B1	RB-112398-B2	RB-112098-B3	PSB-128A (21.5-22.5	RPSB-26 (13-15	RPSB-33 (15-17	RPSB-40 (19-21	RPSB-48 (22-24	RPSB-54 (12-14	RB-111898-B5	SB-128A (24-	PSB-20 (25-2	PSB-20 (40-4	PSB-25 (40-4	PSB-26 (38-4	PSB-32 (25-2	PSB-32 (40-4	PSB-39 (25-2	PSB-39 (42-4	PSB-40 (26-2
						Start Depth	8.5	13	23	11	12	21.5	13	15	19	22	12	23	24	25	40	40	38	25	40	25	42	26
						End Depth	9	15	24	13	14	22.5	15	17	21	24	14	25	28	27	42	42	40	27	42	27	44	28
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	10/26/1995	11/23/1998	11/18/1998	11/23/1998	11/20/1998	07/26/2002	01/19/2000	12/22/1999	01/20/2000	01/24/2000	01/12/2000	11/18/1998	07/26/2002	12/20/1999	12/20/1999	12/21/1999	01/19/2000	12/21/1999	12/21/1999	02/01/2000	02/01/2000	01/20/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																						
BTEX	mg/kg																											
Benzene		71-43-2	0.06	4.8	44	89	**1.73**	0.0059 U	**0.0008 J**	**2.8 D**	**0.065**	0.002 UJ	**2.3**	0.061 U	**0.005**	0.001 U	1.2 U	**0.1**	0.001 UJ	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	**0.014**	**0.004**	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	**59.6**	**0.014**	0.0012 U	**9.8 D**	**0.019**	**0.028 J**	**0.48**	**0.54**	**0.002**	0.001 U	**5**	**0.086**	0.001 UJ	0.001 U	**0.003**	0.001 U	**0.002**	**0.003**	0.001 U	**0.001**	**0.009**	**0.001 J**
Toluene		108-88-3	0.7	100	500	1000	**6.02**	**0.0084**	**0.0008 J**	**20 D**	**0.079**	**0.026 J**	**2.7**	**0.58**	**0.004**	**0.003**	**33**	**0.052**	0.001 UJ	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	**0.009**	**0.046**	**0.002**
Xylene (total)		1330-20-7	0.26	100	500	1000	NA	**0.026**	**0.005**	**60 D**	**0.067**	**0.068 J**	**1**	**1.6**	**0.003**	**0.002**	**23**	**0.069**	**0.004 J**	0.001 U	**0.003**	**0.002**	**0.005**	**0.005**	0.001 U	**0.009**	**0.1**	0.001 U
Total BTEX							**67.35**	**0.0484**	**0.0066**	**92.6**	**0.23**	**0.122**	**6.48**	**2.72**	**0.014**	**0.005**	**61**	**0.307**	**0.004**	0	**0.006**	**0.002**	**0.011**	**0.008**	0	**0.033**	**0.159**	**0.003**
Volatile Organic Compounds	ug/kg																											
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	**28500**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	150 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																											
Carcinogenic PAHs																												
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**3.5**	2.4 U	0.41 U	**3.4**	0.4 U	0.41 U	4.1 U	**0.18 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.14 J**	0.41 U	0.4 U	0.4 U	0.39 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**3.1**	2.4 U	0.41 U	**2.4 J**	0.4 U	0.41 U	4.1 U	**0.1 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.067 J**	0.41 U	0.4 U	0.4 U	0.39 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**3**	2.4 U	0.41 U	**1.8 J**	0.4 U	0.41 U	4.1 U	**0.12 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.052 J**	0.41 U	0.4 U	0.4 U	0.39 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**2.46**	2.4 U	0.41 U	**0.51 J**	0.4 U	0.41 U	4.1 U	**0.039 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.051 J**	0.41 U	0.4 U	0.4 U	0.39 U
Chrysene		218-01-9	1	3.9	56	110	**4.48**	2.4 U	0.41 U	**2.9**	0.4 U	0.41 U	4.1 U	**0.18 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.16 J**	0.41 U	0.4 U	0.4 U	0.39 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	**0.82**	2.4 U	0.41 U	2.4 U	0.4 U	0.41 U	4.1 U	0.39 U	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	0.37 U	0.41 U	0.4 U	0.4 U	0.39 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**2.60**	2.4 U	0.41 U	**0.94 J**	0.4 U	0.41 U	4.1 U	0.39 U	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	0.37 U	0.41 U	0.4 U	0.4 U	0.39 U
Total Carcinogenic PAHs							**19.96**	0	0	**11.95**	0	0	0	**0.619**	0	0	0	0	0	0	0	0	0	**0.47**	0	0	0	0
Non-Carcinogenic PAHs																												
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**29.5**	2.4 U	0.41 U	**11**	**0.098 J**	0.41 U	4.1 U	**0.33 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	0.37 U	0.41 U	**0.055 J**	0.4 U	0.39 U
Acenaphthene		83-32-9	20	100	500	1000	**9.01**	2.4 U	0.41 U	**5.6**	0.4 U	0.41 U	4.1 U	0.39 U	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.11 J**	0.41 U	0.4 U	0.4 U	0.39 U
Acenaphthylene		208-96-8	100	100	500	1000	**32.3**	2.4 U	0.41 U	**1.4 J**	0.4 U	0.41 U	4.1 U	**0.05 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.066 J**	0.41 U	**0.054 J**	0.4 U	0.39 U
Anthracene		120-12-7	100	100	500	1000	**0.51**	2.4 U	0.41 U	**4.8**	0.4 U	0.41 U	4.1 U	**0.18 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	**0.11 J**	0.41 U	0.39 U	3.9 U	**0.15 J**	0.41 U	**0.065 J**	0.4 U	0.39 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**5.14 J**	2.4 U	0.41 U	**0.94 J**	0.4 U	0.41 U	4.1 U	**0.044 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	0.37 U	0.41 U	0.4 U	0.4 U	0.39 U
Fluoranthene		206-44-0	100	100	500	1000	**3.43**	2.4 U	0.41 U	**6.3**	0.4 U	0.41 U	4.1 U	**0.34 J**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	**0.04 J**	**0.046 J**	0.39 U	3.9 U	**0.29 J**	**0.065 J**	**0.076 J**	0.4 U	0.39 U
Fluorene		86-73-7	30	100	500	1000	**6.49**	2.4 U	0.41 U	**4.5**	0.4 U	0.41 U	4.1 U	**0.22 J**	0.4 U	0.4 U	0.4 U	0.379 U	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	**0.21 J**	0.41 U	**0.098 J**	**0.052 J**	0.39 U
Naphthalene		91-20-3	12	100	500	1000	**45.6**	2.4 U	0.41 U	**49 D**	**0.82**	0.41 U	**4.8**	**1.2**	0.4 U	0.4 U	**0.07 J**	**0.053 J**	0.43 U	0.38 U	0.41 U	0.39 U	3.9 U	0.37 U	0.41 U	0.4 U	0.4 U	0.39 U
Phenanthrene		85-01-8	100	100	500	1000	**7.44**	2.4 U	0.41 U	**17**	0.4 U	0.41 U	4.1 U	**0.92**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	**0.1 J**	**0.11 J**	**0.053 J**	3.9 U	**0.92**	**0.14 J**	**0.32 J**	**0.16 J**	0.39 U
Pyrene		129-00-0	100	100	500	1000	**12.6**	2.4 U	0.41 U	**13**	**0.045 J**	0.41 U	4.1 U	**0.58**	0.4 U	0.4 U	0.4 U	0.38 U	0.43 U	**0.078 J**	**0.095 J**	**0.05 J**	3.9 U	**0.45**	**0.095 J**	**0.11 J**	0.4 U	0.39 U
Total Non-Carcinogenic PAHs							**152.02**	0	0	**113.54**	**0.963**	0	**4.8**	**3.864**	0	0	**0.07**	**0.053**	0	**0.328**	**0.251**	**0.103**	0	**2.196**	**0.3**	**0.778**	**0.212**	0
Total PAHs							**171.98**	0	0	**125.49**	**0.963**	0	**4.8**	**4.483**	0	0	**0.07**	**0.053**	0	**0.328**	**0.251**	**0.103**	0	**2.666**	**0.3**	**0.778**	**0.212**	0
Other Semivolatile Organic Compounds	ug/lg																											
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	**12.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	12000 U	12000 U	12000 U	13000 U	12000 U	NA	NA	15000 U	15000 U	15000 U	12000 U	15000 U	15000 U	12000 U	12000 U	12000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	**1920**	NA	NA	NA	NA	410 U	4100 U	390 U	400 U	400 U	400 U	NA	430 U	380 U	410 U	390 U	3900 U	370 U	410 U	400 U	400 U	390 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																											
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	NA	0.4 U	0.8 U	0.4 U	0.4 U	NA	**0.8 B**	**0.47 B**	**0.74 B**	0.31 U	**0.25 B**	**0.3 B**	NA	0.28 U	0.26 U	**0.31 B**	**0.36 B**	0.26 U	**0.81 B**	0.26 U	**0.81 B**	**0.38 B**
Barium		7440-39-3	350	400	400	10000	NA	**1.7 B**	**2.5 B**	**2.3 B**	**1.9 B**	NA	**2.3 B**	**1.9 B**	**1.7 B**	**1.3 B**	**0.96 B***	**1.8 B**	NA	**1.2 B**	**1.8 B**	**2.4 B**	**1.8 B**	**1.8 B**	**1.9 B**	**1.3 B**	**1.5 B**	**1.6 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	NA	0.07 U	0.07 U	0.07 U	0.07 U	NA	0.19 U	0.17 U	0.22 U	0.21 U	0.14 U	**0.2 B**	NA	0.19 U	0.17 U	0.2 U	0.19 U	0.17 U	0.19 U	0.18 U	0.2 U	0.21 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	NA	**1.5 B**	**2.6**	**2 B**	**2.1 B**	NA	**3.3**	**11.7**	**2.2**	**3.4**	**0.94 B**	**2.84**	NA	**1 B**	**2.2**	**1.4 B**	**1.7 B**	**2.5**	**1.5 B**	**2.6**	**3.3**	**2.2**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	NA	**2.3**	**1**	**0.8**	**1.5**	NA	**0.35 B**	**1.6**	**0.92 B**	**1.2**	**0.85 ***	**0.8**	NA	**0.55 B**	**0.47 B**	**0.59 B**	**0.81 B**	**0.71 B**	**0.89 B**	**1.1**	**0.36 B**	**0.97 B**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	NA	0.1 U	0.12 U	0.1 U	0.12 U	NA	0.02 U	0.017 U	0.017 U	0.018 U	0.019 U	0.12 U	NA	0.019 U	0.021 U	0.019 U	0.02 U	0.015 U	0.018 U	0.018 U	0.02 U	0.017 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	NA	0.8 U	0.8 U	0.8 U	0.8 U	NA	0.37 U	**0.83 B**	0.43 U	0.41 U	0.27 U	0.76 U	NA	0.37 U	0.35 U	0.39 U	0.39 U	0.34 U	0.37 U	0.35 U	0.4 U	0.41 U
Silver		7440-22-4	2	180	1500	6800	NA	0.3 U	0.3 U	0.3 U	0.3 U	NA	**0.56 B**	**0.39 B**	**0.37 B**	0.31 U	0.21 U	0.3 U	NA	0.28 U	0.26 U	0.29 U	**0.35 B**	0.26 U	0.28 U	0.26 U	0.3 U	0.31 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																											
Cyanide, total		57-12-5	27	27	27	10,000	NA	1.2 U	1.2 U	**35.8**	1.2 U	0.25 UJ	**0.28 B**	**0.21 B**	**0.31 B**	**0.22 B**	**0.053 B**	1.2 U	0.28 UJ	**0.081 B**	**0.19 B**	**0.093 B**	**0.18 B**	0.047 U	**0.12 B**	**0.12 B**	0.1 U	**0.18 B**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-40	RPSB-47	RPSB-47	RPSB-52	RPSB-52	RPSB-53	RPSB-53	RPSB-97	RPMW-14D2	RPMW-15D	RPSB-25	RPSB-33	RPSB-48	RPSB-54	RPSB-97	RPSB-97	RPMW-14D2	GP-01	GP-08	GP-09	GP-16	RPSB-13	RPSB-93
						Sample Name	PSB-40 (38-4	PSB-47 (25-2	PSB-47 (40-4	PSB-52 (30-3	PSB-52 (42-4	PSB-53 (25-2	PSB-53 (39-4	PSB-97 (31-3	MW-14D2 (67	MW-15D (67-	PSB-25 (50-5	PSB-33 (45-4	PSB-48 (45-4	PSB-54 (50-5	PSB-97 (47-4	PSB-97 (57-5	MW-14D2 (97-	RB-GP01	RP-GP08 (8-10)	RB-GP09 (8-11)	GP-16	RPSB-13 (4-6)	RPSB93 (6-8)
						Start Depth	38	25	40	30	42	25	39	31	67	67	50	45	45	50	47	57	97	10.00	8	8	4.50	4	6
						End Depth	40	27	42	32	44	27	41	33	77	77	52	47	47	52	49	59	107	10.00	10	11	4.50	6	8
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	01/20/2000	01/13/2000	01/14/2000	01/14/2000	01/14/2000	02/02/2000	02/02/2000	11/26/2001	08/19/2002	08/20/2002	12/21/1999	12/22/1999	01/24/2000	01/13/2000	11/27/2001	11/27/2001	08/20/2002	10/16/1998	10/19/1998	10/19/1998	10/20/1998	01/13/2000	11/01/2001
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																							
BTEX	mg/kg																												
Benzene		71-43-2	0.06	4.8	44	89	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	**0.002**	NA	**3.5**	**4.7**	0.0010 U	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	**0.002**	**0.002**	**0.002**	**0.001 J**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	**0.003**	0.001 U	0.001 U	**0.003**	**0.002**	0.001 U	**0.001**	NA	**130**	**77**	0.0010 U	0.001 U	0.001 U
Toluene		108-88-3	0.7	100	500	1000	**0.001**	**0.001 J**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	**0.004**	**0.004**	**0.014**	**0.029**	**0.002**	**0.002**	NA	**2.1 J**	3.1 U	0.0010 U	**0.001 J**	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.003**	**0.004**	**0.002**	**0.002**	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	**0.004**	**0.002**	**0.004**	**0.003**	**0.039**	**0.021**	0.001 U	**0.002**	NA	**33**	**4.4**	0.0010 U	**0.002**	**0.007**
Total BTEX							**0.008**	**0.007**	**0.004**	**0.003**	0	**0.002**	0	0	0	**0.008**	**0.005**	**0.008**	**0.009**	**0.056**	**0.052**	**0.002**	**0.007**	NA	**168.6**	**86.1**	0	**0.003**	**0.007**
Volatile Organic Compounds	ug/kg																												
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																												
Carcinogenic PAHs																													
Benzo(a)anthracene		56-55-3	1	1	5.6	11	4 U	**1.5**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**26**	**21**	0.35 U	0.34 U	0.35 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	4 U	**1.1**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**18**	**14**	0.35 U	0.34 U	0.35 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	4 U	**1.1**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**18**	**14**	0.35 U	0.34 U	0.35 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	4 U	**0.36 J**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**5.9**	**5**	0.35 U	0.34 U	0.35 U
Chrysene		218-01-9	1	3.9	56	110	4 U	**1.5**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**22**	**20**	0.35 U	0.34 U	0.35 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	4 U	**0.12 J**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**1.1 J**	**0.88 J**	0.35 U	0.34 U	0.35 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	4 U	**0.13 J**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**3.7 J**	**3 J**	0.35 U	0.34 U	0.35 U
Total Carcinogenic PAHs							0	**5.81**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	NA	**94.7**	**77.88**	0	0	0
Non-Carcinogenic PAHs																													
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	4 U	**0.68 J**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**280**	**92 D**	0.35 U	0.34 U	0.35 U
Acenaphthene		83-32-9	20	100	500	1000	4 U	**1.9**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**83**	**89 D**	0.35 U	0.34 U	0.35 U
Acenaphthylene		208-96-8	100	100	500	1000	4 U	**0.51 J**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**7.6**	**4.9**	0.35 U	0.34 U	0.35 U
Anthracene		120-12-7	100	100	500	1000	4 U	**1.9**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**41**	**47 D**	0.35 U	0.34 U	0.35 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	4 U	**0.46 J**	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**2.9 J**	**2.5 J**	0.35 U	0.34 U	0.35 U
Fluoranthene		206-44-0	100	100	500	1000	4 U	**3.8 D**	**0.041 J**	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	**0.042 J**	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**46**	**51 D**	0.35 U	0.34 U	0.35 U
Fluorene		86-73-7	30	100	500	1000	4 U	**2.8**	0.4 U	0.4 U	0.42 U	0.37 U	**0.047 J**	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**63**	**62 D**	0.35 U	0.34 U	0.35 U
Naphthalene		91-20-3	12	100	500	1000	4 U	0.36 U	0.4 U	0.4 U	0.42 U	0.37 U	0.4 U	0.42 U	0.38 U	0.4 U	0.4 U	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**410**	**320 D**	0.35 U	0.34 U	0.35 U
Phenanthrene		85-01-8	100	100	500	1000	4 U	**8.2 D**	0.4 U	**0.15 J**	0.42 U	0.37 U	**0.18 J**	0.42 U	0.38 U	0.4 U	**0.15 J**	**0.047 J**	0.4 U	0.4 U	0.41 U	0.41 U	**0.042 J**	NA	**130**	**160 D**	0.35 U	0.34 U	0.35 U
Pyrene		129-00-0	100	100	500	1000	4 U	**3.7**	**0.051 J**	0.4 U	0.42 U	0.37 U	**0.049 J**	0.42 U	0.38 U	0.4 U	**0.11 J**	0.42 U	0.4 U	0.4 U	0.41 U	0.41 U	0.39 U	NA	**58**	**71 D**	0.35 U	0.34 U	0.35 U
Total Non-Carcinogenic PAHs							0	**23.95**	**0.092**	**0.15**	0	0	**0.276**	0	0	0	**0.302**	**0.047**	0	0	0	0	**0.042**	NA	**1121.5**	**899.4**	0	0	0
Total PAHs							0	29.76	**0.092**	**0.15**	0	0	**0.276**	0	0	0	**0.302**	**0.047**	0	0	0	0	**0.042**	NA	**1216.2**	**977.28**	0	0	0
Other Semivolatile Organic Compounds	ug/lg																												
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	12000 U	13000 U	13000 U	12000 U	12000 U	13000 U	13000 U	NA	NA	NA	15000 U	12000 U	13000 U	12000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	4000 U	**1400**	400 U	400 U	420 U	370 U	400 U	420 U	380 U	400 U	400 U	420 U	400 U	400 U	410 U	410 U	390 U	NA	NA	NA	NA	340 U	350 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																												
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.86**	**0.42 B**	**0.96**	0.36 U	**0.57 B**	**1 B**	**0.72 B**	NA	NA	NA	**0.63 B**	**0.36 B**	0.35 U	**0.79 B**	NA	NA	NA	NA	**10.5**	**11.2**	**1.3 B**	**0.51 B**	NA
Barium		7440-39-3	350	400	400	10000	**1.5 B**	**1.2 B**	**1.8 B**	**1.9 B**	**2.2 B**	**1.6 B**	**1.8 B**	NA	NA	NA	**1.8 B**	**3 B**	**1.9 B**	**1.5 B***	NA	NA	NA	NA	**41 B**	**45.1 B**	**7.2 B**	**3.3 B***	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.17 U	0.2 U	0.16 U	**0.25 B**	0.22 U	**0.059 B**	**0.084 B**	NA	NA	NA	0.2 U	**0.23 B**	0.23 U	0.18 U	NA	NA	NA	NA	**0.9 B**	**1.2 B**	**0.2 B**	**0.32 B**	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**1.8**	**3.3**	**2.1**	**2.5**	**1.9 B**	**2.2**	**6.1**	NA	NA	NA	**1.6 B**	**2.7**	**2.9**	**3.7**	NA	NA	NA	NA	**9.8**	**7.1**	**2.1**	**1.8 B**	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**0.47 B**	**1.2**	**2.7**	**2.1**	**1.5**	0.22 U	0.22 U	NA	NA	NA	**0.5 B**	**2.2**	**0.84 B**	**1.4 ***	NA	NA	NA	NA	**50.7**	**94.6**	**1.6**	**2.2 ***	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.02 U	0.018 U	0.019 U	0.017 U	0.018 U	0.018 U	0.02 U	NA	NA	NA	0.02 U	0.019 U	0.21 U	0.018 U	NA	NA	NA	NA	0.1 U	0.1 U	0.1 U	0.017 U	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.33 U	0.39 U	**0.85 B**	0.48 U	0.44 U	0.38 U	0.38 U	NA	NA	NA	0.39 U	**0.76 B**	0.47 U	0.36 U	NA	NA	NA	NA	**1.4**	**1.5**	0.7 U	0.38 U	NA
Silver		7440-22-4	2	180	1500	6800	0.25 U	0.29 U	0.24 U	**0.39 B**	**0.48 B**	**0.32 B**	**0.27 B**	NA	NA	NA	0.3 U	**0.28 B**	0.35 U	0.27 U	NA	NA	NA	NA	**0.8 B**	**0.4 B**	0.3 U	0.29 U	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																												
Cyanide, total		57-12-5	27	27	27	10,000	**0.22 B**	**0.13 B**	**0.25 B**	**0.28 B**	**0.34 B**	0.062 U	0.07 U	0.27 U	0.25 UJ	0.25 U	**0.12 B**	**0.096 B**	**0.24 B**	**0.085 B**	0.30 U	0.29 U	0.25 UJ	**3.5**	**2.9**	NA	1.0 U	0.039 U	7 U

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Analyte	Units	CAS No.	Unrestricted SCO	Restricted Residential SCO	Commercial SCO	Industrial SCO	Location Name	RPSB-94	RPSB-95	RPSB-96	TP-01B	TP-04C	TP-19B	B-04	B-04	GP-20	MW-01	RPSB-125	RPSB-126	RPSB-129	BOR-B	RPSB-125	RPSB-126	RPSB-129	RPSB-13
							Sample Name	RPSB-94 (4-6)	RPSB-95 (4-6)	RPSB-96 (4-6)	RPTP-1 (9-10)	TP-4	RPTP-19 (8-8.5)	RB-112089-B4	RB-112098-B4	RB-GP20 (13-14)	RB-MW1D (15-16)	RPSB-125 (17-25)	RPSB-126 (12-17)	RPSB-129 (15-17)	BOR-B	RPSB-125 (25-27)	RPSB-126 (27-37)	RPSB-129 (37-47)	RPSB-13 (30-32)
							Start Depth	4	4	4	9	6	8	23.00	23.00	13	15	17	12	15	29.75	25	27	37	30
							End Depth	6	6	6	10	6	8.5	23.00	23.00	14	16	25	17	17	29.75	27	37	47	32
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	10/31/2001	10/31/2001	11/05/2001	10/25/1995	10/21/1998	10/24/1995	11/20/1998	11/20/1998	10/20/1998	10/22/1998	08/21/2002	08/20/2002	08/22/2002	10/22/1998	08/21/2002	08/20/2002	08/22/2002	01/13/2000
BTEX	mg/kg																								
Benzene		71-43-2	0.06	4.8	44	89		0.001 U	0.001 U	0.001 U	**0.81**	1.6 U	**120**	NA	**0.0016**	**0.013**	**0.34**	3 U	**0.22**	**35**	1.4 U	1.2 U	**0.002**	**0.074**	0.001 U
Ethyl benzene		100-41-4	1	41	390	780		0.001 U	0.001 U	0.001 U	**1.57**	**60**	**496**	NA	**0.002**	**0.0086**	**0.25**	**100**	**0.75**	**100**	**51**	**120**	0.001 U	**0.002**	**0.002**
Toluene		108-88-3	0.7	100	500	1000		0.001 U	0.001 U	0.001 U	**0.3**	1.6 U	**783**	NA	**0.0011**	0.006 U	0.15 U	3 U	**0.063**	1.2 U	1.4 U	1.2 U	**0.002**	**0.001**	**0.002**
Xylene (total)		1330-20-7	0.26	100	500	1000		0.001 U	0.001 U	**0.005**	**0.87**	**6.7**	**823**	NA	**0.0023**	**0.0098**	0.15 U	**57**	**0.14**	**43**	**5.8**	**45**	**0.002**	**0.002**	**0.004**
Total BTEX								0	0	**0.005**	**3.55**	**66.7**	**2222**	NA	**0.007**	**0.0314**	**0.59**	**157**	**1.173**	**179**	**56.8**	**165**	**0.006**	**0.079**	**0.008**
Volatile Organic Compounds	ug/kg																								
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		NA	NA	NA	**760**	NA	**175000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		NA	NA	NA	140 U	NA	140 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																								
Carcinogenic PAHs																									
Benzo(a)anthracene		56-55-3	1	1	5.6	11		0.34 U	0.38 U	**0.97**	**0.52**	**28 DJ**	**119**	NA	0.37 U	**0.67**	**1.8**	**42 JD**	**0.44 J**	**28 J**	**79 DJ**	**40 JD**	0.39 U	0.42 U	0.39 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1		0.34 U	0.38 U	**0.98**	**0.36**	**25**	**75.4**	NA	0.37 U	**0.82**	**2.1**	**27 JD**	**0.39 J**	**19 J**	**50 DJ**	**28 JD**	0.39 U	0.42 U	0.39 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.34 U	0.38 U	**2**	**0.17**	**29**	**32.5**	NA	0.37 U	**0.71**	**2**	**29 J**	**0.41 J**	**14 J**	**31 DJ**	**28 J**	0.39 U	0.42 U	0.39 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.34 U	0.38 U	**0.9**	**0.20**	**8.9**	**49.5**	NA	0.37 U	**0.16 J**	**0.61**	**9.6 J**	**0.16 J**	**6.8 J**	**9.5**	**9.4 J**	0.39 U	0.42 U	0.39 U
Chrysene		218-01-9	1	3.9	56	110		0.34 U	0.38 U	**1.2**	**0.59**	**25**	**107**	NA	0.37 U	**0.74**	**1.8**	**42 JD**	**0.53 J**	**27 J**	**65 DJ**	**40 JD**	0.39 U	0.42 U	0.39 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.34 U	0.38 U	**0.25 J**	0.14 U	**2.0 J**	**8.16**	NA	0.37 U	**0.069 J**	**0.12 J**	**2.9 J**	0.74 U	40 U	**2.4**	**2.7 J**	0.39 U	0.42 U	0.39 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.34 U	0.38 U	**0.71**	**0.10 J**	**7.2**	**24**	NA	0.37 U	**0.27 J**	**0.47**	**8.2**	**0.14 J**	**4.7 J**	**5.9**	**7.2 J**	0.39 U	0.42 U	0.39 U
Total Carcinogenic PAHs								0	0	**7.01**	**1.94**	**125.1**	**415.56**	NA	0	**3.439**	**8.9**	**160.7**	**2.07**	**99.5**	**242.8**	**155.3**	0	0	0
Non-Carcinogenic PAHs																									
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		0.34 U	0.38 U	0.39 U	**3.20**	**220 D**	**480**	NA	0.37 U	**0.26 J**	**0.96**	**580 D**	**2.7**	**280**	**710 D**	**460 D**	0.39 U	0.42 U	0.39 U
Acenaphthene		83-32-9	20	100	500	1000		0.34 U	0.38 U	0.39 U	**5.80**	**33**	**191**	NA	0.37 U	**2.6**	**0.33 J**	**280 D**	**0.42 J**	**150**	**390 D**	**240 D**	0.39 U	0.42 U	0.39 U
Acenaphthylene		208-96-8	100	100	500	1000		0.34 U	0.38 U	**1.4**	**0.27**	**6.1**	**110**	NA	0.37 U	**0.12**	**2.9 D**	**20**	**0.13 J**	**9 J**	**19 DJ**	**17**	0.39 U	0.42 U	0.39 U
Anthracene		120-12-7	100	100	500	1000		0.34 U	0.38 U	**0.44**	**2.97**	**33**	**212**	NA	0.37 U	**0.19 J**	**0.97**	**96 JD**	**1.1**	**56**	**170 D**	**90 D**	0.39 U	0.42 U	0.39 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.34 U	0.38 U	**0.79**	**0.13 J**	**6.1**	**26.5**	NA	0.37 U	**0.29 J**	**0.4 J**	**7.6 J**	**0.16 J**	**4.9 J**	**5.7**	**7 J**	0.39 U	0.42 U	0.39 U
Fluoranthene		206-44-0	100	100	500	1000		0.34 U	0.38 U	**0.9**	**1.48**	**42 D**	**172**	NA	0.37 U	**0.69**	**2.3**	**78 JD**	**0.93**	**55**	**120 D**	**74 JD**	0.39 U	0.42 U	0.39 U
Fluorene		86-73-7	30	100	500	1000		0.34 U	0.38 U	0.39 U	**3.51**	**28**	**181**	NA	0.369 U	**0.59**	**1.1**	**130 JD**	**0.91**	**81**	**200 D**	**120 D**	0.39 U	0.42 U	0.39 U
Naphthalene		91-20-3	12	100	500	1000		0.34 U	0.38 U	**0.065 J**	**8.49**	**200 D**	**957**	NA	**0.047 J**	**2.7**	**7.9 D**	**810 D**	**7.9**	**510**	**660 D**	**520 D**	0.39 U	0.42 U	0.39 U
Phenanthrene		85-01-8	100	100	500	1000		0.34 U	0.38 U	**0.22 J**	**8.51**	**78 D**	**537**	NA	0.37 U	**0.77**	**2.9**	**340 D**	**1.4**	**210**	**600 D**	**300 D**	0.39 U	**0.078 J**	0.39 U
Pyrene		129-00-0	100	100	500	1000		0.34 U	0.38 U	**1.7**	**2.22**	**59 D**	**263**	NA	0.37 U	**1.6**	**2.9**	**130 JD**	**1.1**	**84**	**300 D**	**120 D**	0.39 U	0.42 U	0.39 U
Total Non-Carcinogenic PAHs								0	0	**5.515**	**36.58**	**705.2**	**3129.5**	NA	**0.047**	**9.81**	**22.66**	**2471.6**	**16.75**	**1439.9**	**3174.7**	**1948**	0	**0.078**	0
Total PAHs								0	0	**12.525**	**38.52**	**830.3**	**3545.06**	NA	**0.047**	**13.249**	**31.56**	**2632.3**	**18.82**	**1539.4**	**3417.5**	**2103.3**	0	**0.078**	0
Other Semivolatile Organic Compounds	ug/kg																								
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE		NA	NA	NA	**6.80**	NA	**291**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		340 U	380 U	390 U	**530**	NA	**25500**	NA	NA	NA	NA	**9700**	740 U	**5400 J**	NA	**7900**	390 U	420 U	390 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																								
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		NA	NA	NA	NA	**4.9**	NA	0.3 U	NA	**2.4**	NA	NA	NA	NA	NA	NA	NA	NA	0.29 U
Barium		7440-39-3	350	400	400	10000		NA	NA	NA	NA	**51.2**	NA	1.3 U	NA	**14 B**	NA	NA	NA	NA	NA	NA	NA	NA	**2.5 B***
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		NA	NA	NA	NA	**2.0**	NA	0.07 U	NA	**0.2 B**	NA	NA	NA	NA	NA	NA	NA	NA	0.19 U
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		NA	NA	NA	NA	**12**	NA	**1.2 B**	NA	**4.8**	NA	NA	NA	NA	NA	NA	NA	NA	**2.1**
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		NA	NA	NA	NA	**28.1**	NA	**0.6 B**	NA	**20.8**	NA	NA	NA	NA	NA	NA	NA	NA	**1.8 ***
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		NA	NA	NA	NA	0.1 U	NA	0.11 U	NA	0.1 U	NA	NA	NA	NA	NA	NA	NA	NA	0.019 U
Nickel		7440-02-0	30	310	310	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		NA	NA	NA	NA	**1.9**	NA	0.74 U	NA	0.8 U	NA	NA	NA	NA	NA	NA	NA	NA	0.39 U
Silver		7440-22-4	2	180	1500	6800		NA	NA	NA	NA	0.3 U	NA	**1.3 B**	NA	0.3 U	NA	NA	NA	NA	NA	NA	NA	NA	0.29 U
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																								
Cyanide, total		57-12-5	27	27	27	10,000		0.35 U	0.35 U	**12.8**	NA	**17.2**	NA	1.1 U	NA	1.2 U	NA	0.25 U	0.27 U	0.27 U	NA	0.27 U	0.25 U	**0.32 B**	**0.079 B**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-13	RPSB-19	RPSB-95	RPSB-96	RPMW-18D	RPMW-18D	RPSB-125	RPSB-126	RPSB-19	RPMW-18D	RPSB-129	RPMW-08D2	RPSB-09A	RPSB-118	RPSB-120
							Sample Name	RPSB-13 (38-40)	RPSB-19 (30-32)	RPSB-95 (36-38)	RPSB96 (38-40)	RPMW-180 (52-55)	RPMW-18D (81-83)	RPSB-125 (63-67)	RPSB-126 (47-57)	RPSB-19 (45-47)	RPMW-18D (87-97)	RPSB-129 (87-97)	RPMW-0802 (7-10)	RPSB-09A (8-12)	RPSB-118 (7-12.5)	RPSB-120 (7-12)
							Start Depth	38	30	36	38	52	81	63	47	45	87	87	7	8	7	7
							End Depth	40	32	38	40	55	83	67	57	47	97	97	10	12	12.5	12
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	01/14/2000	01/03/2000	10/31/2001	11/06/2001	08/21/2002	08/21/2002	08/21/2002	08/20/2002	01/03/2000	08/21/2002	08/22/2002	08/22/2002	07/25/2002	08/16/2002	08/16/2002
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																
BTEX	mg/kg																					
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	**0.004**	0.001 U	0.001 U	0.28 U	0.24 U	0.001 U	**0.003**	0.001 U	0.001 U	**0.024**	**0.005**	**0.11**	**5**	**0.4**
Ethyl benzene		100-41-4	1	41	390	780	0.001 U	**0.012**	0.001 U	0.001 U	**14**	**12**	**0.006**	**0.002**	**0.001**	0.001 U	0.001 U	0.001 U	**3.7**	**20**	**2.2**
Toluene		108-88-3	0.7	100	500	1000	0.001 U	**0.01**	0.001 U	0.001 U	0.28 U	**1.5**	0.001 U	**0.009**	0.001 U	0.001 U	0.001 U	0.001 U	**0.079**	1.2 U	**0.12**
Xylene (total)		1330-20-7	0.26	100	500	1000	0.001 U	**0.023**	0.001 U	0.001 U	**5.2**	**41**	**0.002**	**0.006**	**0.002**	0.001 U	0.001 U	0.001 U	**3.4**	**15**	**0.88**
Total BTEX							0	**0.049**	0	0	**19.2**	**54.5**	**0.008**	**0.02**	**0.003**	0	**0.024**	**0.005**	**7.289**	**40**	**3.6**
Volatile Organic Compounds	ug/kg																					
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																					
Carcinogenic PAHs																						
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.38 U	0.4 U	0.41 U	0.4 U	**46**	**50 JD**	**0.2 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.088 J**	**17**	**21**	**42**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.38 U	0.4 U	0.41 U	0.4 U	**35 J**	**34 JD**	**0.14 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.065 J**	**10 J**	**14**	**42**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.38 U	0.4 U	0.41 U	0.4 U	**27 J**	**27 JD**	**0.098 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.068 J**	**13**	**16**	**46**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.38 U	0.4 U	0.41 U	0.4 U	**13 J**	**18 J**	**0.049 J**	0.42 U	0.39 U	0.42 U	0.43 U	0.42 U	12 U	**7.2 J**	**18**
Chrysene		218-01-9	1	3.9	56	110	0.38 U	0.4 U	0.41 U	0.4 U	**47**	**48 JD**	**0.2 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.1 J**	**18**	**22**	**49**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.38 U	0.4 U	0.41 U	0.4 U	38 U	**3.3 J**	0.43 U	0.42 U	0.39 U	0.42 U	0.43 U	0.42 U	**1.5 J**	**1.4 J**	**3.6 J**
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.38 U	0.4 U	0.41 U	0.4 U	**7.5 J**	**8.7 J**	0.43 U	0.42 U	0.39 U	0.42 U	0.43 U	0.42 U	**6.7 J**	**5 J**	**11 J**
Total Carcinogenic PAHs							0	0	0	0	**175.5**	**189**	**0.687**	0	0	0	0	**0.321**	**66.2**	**86.6**	**211.6**
Non-Carcinogenic PAHs																						
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.38 U	0.4 U	0.41 U	0.4 U	**220**	**380 D**	**0.15 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.052 J**	**42**	**22**	17 U
Acenaphthene		83-32-9	20	100	500	1000	0.38 U	0.4 U	0.41 U	0.4 U	**41**	**28**	**0.2 J**	0.42 U	0.39 U	0.42 U	0.43 U	0.42 U	**6.6 J**	**43**	**26**
Acenaphthylene		208-96-8	100	100	500	1000	0.38 U	0.4 U	0.41 U	0.4 U	**210**	**270 D**	**0.42 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.046 J**	**11 J**	**5 J**	**13 J**
Anthracene		120-12-7	100	100	500	1000	0.38 U	0.4 U	0.41 U	0.4 U	**100**	**110 D**	**0.43**	0.42 U	0.39 U	0.42 U	0.43 U	**0.046 J**	**14**	**27**	**48**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.38 U	0.4 U	0.41 U	0.4 U	**6.4 J**	**8.4 J**	**0.044 J**	0.42 U	0.39 U	0.42 U	0.43 U	0.42 U	**7.6 J**	**5.7 J**	**12 J**
Fluoranthene		206-44-0	100	100	500	1000	0.38 U	**0.068 J**	0.41 U	0.4 U	**86**	**92 JD**	**0.37 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.14 J**	**32**	**47**	**86**
Fluorene		86-73-7	30	100	500	1000	0.38 U	0.4 U	0.41 U	0.4 U	**140**	**160 D**	**0.34 J**	0.42 U	0.39 U	0.42 U	0.43 U	**0.052 J**	**23**	**39**	**25**
Naphthalene		91-20-3	12	100	500	1000	0.38 U	0.4 U	0.41 U	0.4 U	**320**	**630 D**	**0.2 J**	0.42 U	0.39 U	0.42 U	0.43 U	0.42 U	**99**	**93**	**7.3 J**
Phenanthrene		85-01-8	100	100	500	1000	0.38 U	**0.15 J**	0.41 U	0.4 U	**320**	**370 D**	**1.4**	0.42 U	0.39 U	0.42 U	0.43 U	**0.24 J**	**81**	**110**	**84**
Pyrene		129-00-0	100	100	500	1000	0.38 U	**0.092 J**	0.41 U	0.4 U	**140**	**160 D**	**0.59**	0.42 U	0.39 U	0.42 U	0.43 U	**0.23 J**	**56**	**83**	**130**
Total Non-Carcinogenic PAHs							0	**0.31**	0	0	**1583.4**	**2208.4**	**4.144**	0	0	0	0	**0.806**	**372.2**	**474.7**	**431.3**
Total PAHs							0	**0.31**	0	0	**1758.9**	**2397.4**	**4.831**	0	0	0	0	**1.127**	**438.4**	**561.3**	**642.9**
Other Semivolatile Organic Compounds	ug/lg																					
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	13000 U	14000 U	NA	NA	NA	NA	NA	NA	14000 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	380 U	400 U	410 U	400 U	**12000 J**	**10000**	430 U	420 U	390 U	420 U	430 U	420 U	**2900 J**	**4200 J**	**3100 J**
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																					
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.94 B**	0.36 U	NA	NA	NA	NA	NA	NA	**0.42 B**	NA	NA	NA	NA	NA	NA	NA
Barium		7440-39-3	350	400	400	10000	**1.8 B**	**3.1 B**	NA	NA	NA	NA	NA	NA	**1.7 B**	NA	NA	NA	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.21 U	0.24 U	NA	NA	NA	NA	NA	NA	0.2 U	NA	NA	NA	NA	NA	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**1.5 B**	**3.2**	NA	NA	NA	NA	NA	NA	**1.6 B**	NA	NA	NA	NA	NA	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**0.68 B**	**0.87 B**	NA	NA	NA	NA	NA	NA	**0.7 B**	NA	NA	NA	NA	NA	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.018 U	**0.037 B**	NA	NA	NA	NA	NA	NA	0.02 U	NA	NA	NA	NA	NA	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.41 U	0.48 U	NA	NA	NA	NA	NA	NA	**0.45 B**	NA	NA	NA	NA	NA	NA	NA
Silver		7440-22-4	2	180	1500	6800	0.31 U	0.36 U	NA	NA	NA	NA	NA	NA	0.3 U	NA	NA	NA	NA	NA	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																					
Cyanide, total		57-12-5	27	27	27	10,000	**0.27 B**	0.045 U	0.39 U	7 U	0.27 U	0.28 U	0.31 U	0.28 U	**0.058 B**	0.31 U	0.32 U	0.29 U	**9.3**	**2.2**	**1 B**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-121	RPSB-122	RPSB-122	RPSB-122	RPSB-124	RPSB-15	RPSB-15	RPSB-18	RPSB-21	RPSB-22	RPSB-27	RPSB-27	RPSB-29	RPSB-30
							Sample Name	RPSB-121 (7-8.5)	RPSB-122 (7-11.5)	RPSB-122 (11.5-12)	RPSBXX081902-1	RPSB-124 (7-13)	RPSB-15 (3-5)	RPSB-15 (7-9)	RPSB-18 (10-12)	RPSB-21 (7-9)	RPSB-22 (8-10)	RPSB-27 (10-12)	RPSB27 (10-12)	RPSB-29 (7-9)	RPSB-30 (9-11)
							Start Depth	7	7	11.5	11.5	7	3	7	10	7	8	10	10	7	9
							End Depth	8.5	11.5	12	12 (Dup)	13	5	9	12	9	10	12	12	9	11
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	08/15/2002	08/19/2002	08/19/2002	08/19/2002	08/19/2002	12/15/1999	12/15/1999	12/08/1999	12/15/1999	12/01/1999	12/16/1999	12/16/1999	02/02/2000	01/31/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**															
BTEX	mg/kg																				
Benzene		71-43-2	0.06	4.8	44	89	**15**	0.62 U	0.057 U	0.006 U	**26**	0.001 U	0.001 U	**1**	0.001 U	**4.9**	NA	**7**	**1 J**	**0.74 J**
Ethyl benzene		100-41-4	1	41	390	780	**150**	**11**	**5.4**	**1.3**	**43**	**0.003**	**0.004**	**16**	0.001 U	**14**	NA	**63**	**28**	**15**
Toluene		108-88-3	0.7	100	500	1000	6 U	**1.3**	**0.089**	0.006 U	0.44 U	0.001 U	**0.003**	0.6 U	0.001 U	1.2 U	NA	**31**	3 U	3 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**170**	**120**	**8.3**	**3**	**4.2**	**0.008**	**0.016**	**14**	**0.005**	**29**	NA	**130**	**53**	**16**
Total BTEX							**335**	**132.3**	**13.789**	**3.3**	**73.2**	**0.011**	**0.023**	**31**	**0.005**	**47.9**	NA	**231**	**82**	**31.74**
Volatile Organic Compounds	ug/kg																			
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	**3 J**	NA	NA	NA	NA	NA	NA	3000 U	3000 U
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	**20 B**	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	**12**	NA	NA	NA	NA	NA	NA	**17000**	**14000**
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	**4 J**	NA	NA	NA	NA	NA	NA	**6100**	**4700**
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	**2500 J**	**2000 J**
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	**22**	NA	NA	NA	NA	NA	NA	3000 U	3000 U
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	**980 J**	**770 J**
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	**2 J**	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	**2 J**	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
Semivolatile Organic Compounds	mg/kg																			
Carcinogenic PAHs																				
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**58 J**	**0.3 J**	**7.6**	**13**	**22 J**	**0.82**	**0.097 J**	**0.22 J**	**0.08 J**	**39 DJ**	**73 DJ**	NA	**37 J**	**73 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**50 J**	**0.17 J**	**6.1**	**11 J**	**16 J**	**0.75**	**0.07 J**	**0.16 J**	0.41 U	**28 DJ**	**53 DJ**	NA	**28 J**	**53 J**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**44 J**	**0.29 J**	**6.4**	**13 J**	**16 J**	**1.1**	**0.1 J**	**0.11 J**	0.41 U	**21 DJ**	**45 DJ**	NA	**22 J**	**48 J**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**18 J**	**0.13 J**	**2.6**	**5 J**	**6.8 J**	**0.41**	**0.052 J**	**0.054 J**	0.41 U	**9.2 DJ**	**13**	NA	79 U	**17 J**
Chrysene		218-01-9	1	3.9	56	110	**66 J**	**0.32 J**	**4.7**	**11**	**27 J**	**0.97**	**0.1 J**	**0.19 J**	**0.068 J**	**33 DJ**	**68 DJ**	NA	**35 J**	**70 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	98 U	0.41 U	**0.41 J**	3.9 UJ	39 U	**0.17 J**	0.38 U	0.39 U	0.41 U	**3**	**5.2**	NA	79 U	120 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**16 J**	**0.085 J**	**1.5 J**	**2.3 J**	**4.8 J**	**0.67**	0.38 U	**0.046 J**	0.41 U	**12 DJ**	**17**	NA	**8.4 J**	**21 J**
Total Carcinogenic PAHs							**252**	**1.295**	**29.31**	**55.3**	**92.6**	**4.89**	**0.419**	**0.78**	**0.148**	**145.2**	**274.2**	NA	**130.4**	**282**
Non-Carcinogenic PAHs																				
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**430**	**4.6**	**2.1**	**4.8**	**240**	**0.22 J**	0.38 U	**0.36 J**	**0.18 J**	0.41 U	**840 D**	NA	**430**	**810**
Acenaphthene		83-32-9	20	100	500	1000	**140**	**0.095 J**	**4.6**	**6.6**	**32 J**	0.37 U	0.38 U	**0.31 J**	0.41 U	**110 DJ**	**170 D**	NA	79 U	**91 J**
Acenaphthylene		208-96-8	100	100	500	1000	**24 J**	**0.36 J**	**1.4 J**	**1.5 J**	39 U	**0.81**	**0.08 J**	**0.18 J**	**0.047 J**	**13 DJ**	**42 DJ**	NA	**19 J**	**31 J**
Anthracene		120-12-7	100	100	500	1000	**88 J**	**0.23 J**	**6.8**	**17**	**28 J**	**0.38**	0.38 U	**0.34 J**	**0.076 J**	**68 DJ**	**95 DJ**	NA	**64 J**	**51 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**20 J**	**0.096 J**	**1.4 J**	**2.2 J**	**5.6 J**	**0.77**	0.38 U	**0.059 J**	0.41 U	**12 DJ**	**19**	NA	**9.1 J**	**24 J**
Fluoranthene		206-44-0	100	100	500	1000	**140**	**0.73**	**19**	**30**	**56**	**0.95**	**0.1 J**	**0.4**	**0.13 J**	**80 DJ**	**130 D**	NA	**61 J**	**130**
Fluorene		86-73-7	30	100	500	1000	**120**	**0.42**	**4.7**	**7.6**	**54**	**0.15 J**	0.38 U	**0.37 J**	**0.086 J**	**86 D**	**170 D**	NA	**84**	**140**
Naphthalene		91-20-3	12	100	500	1000	**930**	**3.5**	**6.4**	**33**	**340**	**0.32 J**	0.38 U	**0.75**	**0.1 J**	**840 D**	**1200 D**	NA	**840**	**1400**
Phenanthrene		85-01-8	100	100	500	1000	**330**	**1.2**	**26**	**44**	**170**	**0.78**	**0.081 J**	**1.3**	**0.34 J**	**240 D**	**480 D**	NA	**220**	**390**
Pyrene		129-00-0	100	100	500	1000	**190**	**0.94**	**20**	**34**	**77**	**1.8**	**0.2 J**	**0.62**	**0.23 J**	**100 D**	**220 D**	NA	**100**	**220**
Total Non-Carcinogenic PAHs							**2412**	**12.171**	**92.4**	**180.7**	**1002.6**	**6.18**	**0.461**	**4.689**	**1.189**	**1549**	**3366**	NA	**1827.1**	**3287**
Total PAHs							**2664**	**13.466**	**121.71**	**236**	**1095.2**	**11.07**	**0.88**	**5.469**	1.337	**1694.2**	**3640.2**	NA	**1957.5**	**3569**
Other Semivolatile Organic Compounds	ug/lg																			
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	6 U	NA	NA	NA	NA	NA	NA	3000 U	3000 U
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	370 U	15000 U	13000 U	15000 U	15000 U	15000 U	NA	79000 U	120000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	**260 J**	NA	NA	NA	NA	NA	NA	79000 U	120000 U
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
Dibenzofuran		132-64-9	7000	59000	350000	1000000	**13000 J**	**65 J**	**2400**	**3300 J**	**14000 J**	370 U	380 U	390 U	410 U	**6400**	**21000**	NA	**11000 J**	**18000 J**
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	370 U	NA	NA	NA	NA	NA	NA	79000 U	120000 U
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**960 J**	NA
Metals	mg/kg																			
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	**1060**	NA	NA	NA	NA	NA	NA	**303**	**161**
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.19 U	NA	NA	NA	NA	NA	NA	0.3 U	**0.33 B**
Arsenic		7440-38-2	13	16	16	16	NA	NA	NA	NA	NA	**1.6**	**0.98 B**	0.35 U	**0.56 B**	0.33 U	NA	**1.5**	**0.62 B**	0.31 U
Barium		7440-39-3	350	400	400	10000	NA	NA	NA	NA	NA	**25.4**	**6.8 B**	**1.6 B**	**4.4 B**	**2.4 B**	NA	**5.4 B**	**2.1 B**	**1.1 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	0.19 U	NA	NA	NA	NA	NA	NA	0.2 U	0.21 U
Cadmium		7440-43-9	2.5	4.3	9.3	60	NA	NA	NA	NA	NA	**0.51**	**0.22 B**	0.23 U	0.19 U	0.22 U	NA	0.21 U	**0.091 B**	0.21 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	**50200**	NA	NA	NA	NA	NA	NA	**294**	**49.6 B**
Chromium		7440-47-3	NE	NE	NE	NE	NA	NA	NA	NA	NA	**2.6**	**4.2**	**1.8 B**	**3.2**	**1.6 B**	NA	**2.7**	**1.9 B**	**0.89 B**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	**0.81 B**	NA	NA	NA	NA	NA	NA	**0.5 B**	0.31 U
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	**8.3**	NA	NA	NA	NA	NA	NA	**1.1 B**	**0.82 B**
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	**3740**	NA	NA	NA	NA	NA	NA	**1290**	**1310**
Lead		7439-92-1	63	400	1000	3900	NA	NA	NA	NA	NA	**36.8**	**11.5**	**1.8**	**1.1**	**3**	NA	**12.6**	**0.76 B***	**0.36 B**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	**1410**	NA	NA	NA	NA	NA	NA	**135**	**69.1**
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	**27.4**	NA	NA	NA	NA	NA	NA	**9.6**	**4.8 B**
Mercury		7439-97-6	0.18	0.81	2.8	5.7	NA	NA	NA	NA	NA	**0.05**	0.019 U	0.019 U	0.019 U	0.02 U	NA	**0.018 B**	0.02 U	0.019 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	**3.5 B**	NA	NA	NA	NA	NA	NA	**1.1 B**	**0.71 B**
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	**199**	NA	NA	NA	NA	NA	NA	**125 B**	**66.4 B**
Selenium		7782-49-2	3.9	180	1500	6800	NA	NA	NA	NA	NA	0.37 U	0.42 U	**0.5 B**	**0.47 B**	0.44 U	NA	**1.1 B**	0.39 U	0.42 U
Silver		7440-22-4	2	180	1500	6800	NA	NA	NA	NA	NA	**0.88 B**	0.32 U	0.35 U	0.29 U	0.33 U	NA	0.31 U	**0.26 B**	0.31 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	**776**	NA	NA	NA	NA	NA	NA	**37.2 B**	**54.5 B**
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	0.28 U	NA	NA	NA	NA	NA	NA	0.3 U	0.31 U
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	**4.2 B**	NA	NA	NA	NA	NA	NA	**0.49 B**	0.21 U
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	**32.7**	NA	NA	NA	NA	NA	NA	**3.1 B**	**4.2 B**
Total Cyanide	mg/kg																			
Cyanide, total		57-12-5	27	27	27	10,000	0.28 U	0.29 UJ	0.28 UJ	0.26 UJ	0.43 UJ	**2.1**	**4.8**	**0.15 B**	**0.66**	**0.045 B**	NA	**0.1 B**	**0.23 B**	**0.099 B**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-31B	RPSB-31B	RPSB-34	RPSB-35	RPSB-36	RPSB-37	RPSB-38	RPSB-38	RPSB-41	RPSB-41	RPSB-42	RPSB-43	RPSB-44	RPSB-46
							Sample Name	RPSB-31B (4-6)	RPSB-31B (6-8)	RPSB-34 (8-10)	RPSB-35 (10-12)	RPSB-36 (7-9)	RPSB-37 (10-12)	RPSB-38 (4-6)	RPSB-38 (10-12)	RPSB-41 (7-9)	RPSB-41 (9-11)	RPSB-42 (10-12)	RPSB-43 (9-11)	RPSB-44 (10-12)	RPSB-46 (8-10)
							Start Depth	4	6	8	10	7	10	4	10	7	9	10	9	10	8
							End Depth	6	8	10	12	9	12	6	12	9	11	12	11	12	10
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	01/11/2000	01/11/2000	12/29/1999	01/03/2000	01/03/2000	01/12/2000	01/13/2000	01/13/2000	12/15/1999	12/16/1999	01/19/2000	12/01/1999	12/03/1999	12/20/1999
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**															
BTEX	mg/kg																				
Benzene		71-43-2	0.06	4.8	44	89	**0.001 J**	1.2 U	**0.005**	**41**	**12**	**0.33**	**0.03**	0.012 U	61 U	0.31 U	**0.39**	1.2 U	**1.7**	**4.3**
Ethyl benzene		100-41-4	1	41	390	780	**0.002**	**14**	**0.07**	**120**	**53**	**3**	**0.026**	**0.23**	**75**	**7.4**	**2.6**	**7**	**56**	**35**
Toluene		108-88-3	0.7	100	500	1000	0.001 U	1.2 U	0.001 U	**33**	0.57 U	0.12 U	**0.023**	0.012 U	**60 J**	**1.8**	**0.21**	**2.5**	1.2 U	0.6 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.009**	**17**	**0.052**	**260**	**10**	**2.5**	**0.054**	**0.29**	**240**	**20**	**2.7**	**6.7**	**90**	**14**
Total BTEX							**0.012**	**31**	**0.127**	**454**	**75**	**5.83**	**0.133**	**0.52**	**375**	**29.2**	**5.9**	**16.2**	**147.7**	**53.3**
Volatile Organic Compounds	ug/kg																				
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	**17**	NA	61000 U	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	**6 J**	NA	**90000**	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	**4 J**	NA	**33000 J**	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	**120**	NA	**37000 J**	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	**1 J**	NA	61000 U	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**4 J**	NA	61000 U	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																				
Carcinogenic PAHs																					
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**0.038 J**	**4.5 J**	**28**	**41 E**	**24**	**3.2 J**	**1.1**	**5.8 J**	**67 DJ**	**60 DJ**	**5.9**	**32 DJ**	**43 DJ**	**45 D**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**0.064 J**	**5.2 J**	**24**	**27 E**	**18**	**1.7 J**	**1**	**4.1 J**	**47 DJ**	**32**	**3.6 J**	**25 DJ**	**37 DJ**	**48 D**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.35 U	**5.7 J**	**17**	**20 E**	**17**	**1.7 J**	**1.1**	**4.3 J**	**35 DJ**	**25**	**2.7 J**	**18 DJ**	**27 DJ**	**36 D**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.35 U	**0.92 J**	**7**	**7.3 E**	**6.6**	**0.97 J**	**1.5**	**2.4 J**	**20**	**11**	**1.4 J**	**8.4 DJ**	**12 DJ**	**23 D**
Chrysene		218-01-9	1	3.9	56	110	0.35 U	**3.5 J**	**25**	**33 E**	**22**	**3.7 J**	**1.3**	**6 J**	**61 DJ**	**48 DJ**	**5.8**	**30 DJ**	**40 DJ**	**38 D**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.35 U	7.6 U	**1.6 J**	**2.5**	**1.5 J**	7.9 U	**0.28 J**	7.5 U	**10**	**2.9**	**0.45 J**	**1.8**	**3**	**4**
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**0.24 J**	**2.9 J**	**8.8**	**11 E**	**7.8**	7.9 U	**1.9**	7.5 U	**37 E**	**8.8**	**1.1 J**	**7.7 DJ**	**11**	**19**
Total Carcinogenic PAHs							**0.342**	**22.72**	**111.4**	**141.8**	**96.9**	**11.27**	**8.18**	**22.6**	**277**	**187.7**	**20.95**	**122.9**	**173**	**213**
Non-Carcinogenic PAHs																					
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.35 U	**8**	**240 D**	**640 DJ**	**230 D**	**46**	**0.59**	**43**	**740 D**	**740 D**	**39**	**210 D**	**300 D**	**85 D**
Acenaphthene		83-32-9	20	100	500	1000	0.35 U	**2.9 J**	**83 D**	**60 E**	**37**	**3.7 J**	0.41 U	**7.8**	**120 D**	**59 DJ**	**10**	**110 D**	**130 D**	**69 D**
Acenaphthylene		208-96-8	100	100	500	1000	**0.36**	**1.8 J**	**4.8**	**7.9 E**	**6.7**	7.9 U	**1.1**	**1.2 J**	**200 D**	**250 D**	3.9 U	**17 DJ**	**11**	**37 D**
Anthracene		120-12-7	100	100	500	1000	**0.096 J**	**2.4 J**	**43**	**44 E**	**31**	**2.8 J**	**0.9**	**4.8 J**	**150 DJ**	**130 D**	**7.4**	**84 D**	**77 D**	**54 D**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**0.96**	**3.7 J**	**10**	**14 E**	**10**	7.9 U	**2.4**	**0.81 J**	**37 E**	**9.1**	**1.5 J**	**9.1 DJ**	**13**	**23**
Fluoranthene		206-44-0	100	100	500	1000	**0.036 J**	**7.8**	**38**	**50 E**	**32**	**6.1 J**	**1.4**	**12**	**110 DJ**	**110 D**	**7.8**	**62 D**	**99 D**	**76 D**
Fluorene		86-73-7	30	100	500	1000	**0.042 J**	**3.9 J**	**47**	**44 E**	**42**	**10**	0.41 U	**12**	**190 D**	**190 D**	**8.5**	**73 D**	**100 D**	**45 D**
Naphthalene		91-20-3	12	100	500	1000	**0.13 J**	**97**	**510 D**	**1300 D**	**460 D**	**90**	**0.86**	**70**	**1400 B**	**1000 D**	**37**	**500 D**	**620 D**	**220 D**
Phenanthrene		85-01-8	100	100	500	1000	**0.058 J**	**8**	**180 D**	**180 E**	**140 E**	**29**	**0.91**	**42**	**520 D**	**480 D**	**27**	**200 D**	**280 D**	**200 D**
Pyrene		129-00-0	100	100	500	1000	**0.078 J**	**16**	**750 D**	**120 E**	**74 D**	**12**	**2.9**	**26**	**210 D**	**180 D**	**13**	**82 D**	**110 D**	14 D
Total Non-Carcinogenic PAHs							**1.76**	**151.5**	**1905.8**	**2459.9**	**1062.7**	**199.6**	**11.06**	**219.61**	**3677**	**3148.1**	**151.2**	**1347.1**	**1740**	**823**
Total PAHs							**2.102**	**174.22**	**2017.2**	**2601.7**	**1159.6**	**210.87**	**19.24**	**242.21**	**3954**	**3335.8**	**172.15**	**1470**	**1913**	**1036**
Other Semivolatile Organic Compounds	ug/lg																				
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	6 U	NA	61000 U	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	13000 U	13000 U	14000 U	14000 U	14000 U	13000 U	410 U	13000 U	2000 U	15000 U	12000 U	15000 U	15000 U	15000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	350 U	7600 U	**5900**	**8000 E**	**7500**	**2500 J**	410 U	**2400 J**	**20000 DJ**	**23000**	**1500 J**	**4900**	**7800**	**6200**
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	410 U	NA	2000 U	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																				
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**259**	NA	**189**	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**0.23 B**	NA	**0.24 B**	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.5 B**	**1.1**	**0.49 B**	**0.53 B**	**1.1 B**	0.32 U	**1.2**	0.33 U	**0.74 B**	0.32 U	**0.53 B**	**4.6**	**0.63 B**	**0.61 B**
Barium		7440-39-3	350	400	400	10000	**2 B**	**2.9 B**	**2.1 B**	**1.5 B**	**10.6 B**	**2.3 B**	**16.2 B***	**1.5 B**	**4.2 B**	**3.5 B**	**4.3 B**	**87.6**	**5.3 B**	**8.2 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	0.19 U	NA	0.22 U	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.19 U	**0.27 B**	0.22 U	0.21 U	0.22 U	0.22 U	**0.27 B**	0.22 U	0.22 U	0.21 U	0.2 U	**1.4**	**0.22 B**	0.23 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**276**	NA	**90.9**	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**1.9 B**	**1.9 B**	**1.7 B**	**1.2 B**	**2.1 B**	**2 B**	**1.6 B**	**1.5 B**	**1.6 B**	**2.4**	**2.9**	**13.2**	**2**	**2.2 B**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**0.97 B**	NA	0.33 U	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	**6.4**	NA	**6.4**	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**2050**	NA	**610**	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**1.9**	**8.8**	**1.7**	**0.46 B**	**3.6**	**3.9**	**4.2 ***	**1.2**	**6.1**	**1.6**	**3.6**	**23**	**5.5**	**3.6**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**62.6**	NA	**66.9**	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	**6.8**	NA	**4.3 B**	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.017 U	**0.024 B**	0.019 U	0.019 U	0.019 U	**0.055 B**	**0.026 B**	0.02 U	0.018 U	0.019 U	0.018 U	**0.02 B**	0.018 U	0.019 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	**2.1 B**	NA	**0.65 B**	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**62 B**	NA	**105**	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.38 U	0.43 U	**0.44 B**	**0.6 B**	**0.62 B**	**1.2 B**	**1.9**	**0.79 B**	0.44 U	0.42 U	0.4 U	0.42 U	0.35 U	0.46 U
Silver		7440-22-4	2	180	1500	6800	0.28 U	0.32 U	**0.35 B**	0.31 U	**0.48 B**	0.32 U	**0.29 B**	0.33 U	0.33 U	0.32 U	0.3 U	**0.7 B**	0.26 U	**0.77 B**
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**51.6 B**	NA	16.5 U	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	0.28 U	NA	0.33 U	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	**1.3 B**	NA	**0.94 B**	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	**22.1**	NA	**1.5 BE**	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																				
Cyanide, total		57-12-5	27	27	27	10,000	**0.063 B**	0.052 U	**0.075 B**	0.034 U	0.046 U	**0.12 B**	**0.93 B**	**0.29 B**	**0.42 B**	**0.62 B**	**0.35 B**	**2.3**	**0.19 B**	**1.3**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-49	RPSB-50	RPSB-51	RPSB-67	RPSB-67	RPSB-68	RPSB-68	RPSB-69	RPSB-69	RPSB-90	RPSB-91	RPSB-92	RPSV-22	RPSV-23	RPSV-24	TP-10B
							Sample Name	RPSB-49 (8-10)	RPSB-50 (7-9)	RPSB-51 (10-12)	RPSB-67 (2-4)	RPSB-67 (10-12)	RPSB-68 (6-8)	RPSB-68 (8-10)	RPSB-69 (6-8)	RPSB-69 (10-12)	RPSB-90 (4-6)	RPSB91 (6-8)	RPSB-92 (4-6)	RPSV-22	RPSV-23	RPSV-24	RPTP-10 (10-11)
							Start Depth	8	7	10	2	10	6	8	6	10	4	6	4	0.00	0.00	0.00	10
							End Depth	10	9	12	4	12	8	10	8	12	6	8	6	0.00	0.00	0.00	11
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	12/08/1999	12/09/1999	01/10/2000	10/11/1999	10/11/1999	10/11/1999	10/11/1999	10/12/1999	10/12/1999	11/02/2001	11/01/2001	10/29/2001	11/21/2001	11/21/2001	11/21/2001	10/26/1995
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																	
BTEX	mg/kg																						
Benzene		71-43-2	0.06	4.8	44	89	0.56 U	**0.034**	3.2 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.0033**	**0.0016**	**0.0042**	0.12 U
Ethyl benzene		100-41-4	1	41	390	780	**36**	**0.26**	**240**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.0024**	0.00062 U	**0.0012**	0.12 U
Toluene		108-88-3	0.7	100	500	1000	0.56 U	**0.03**	**44**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.0098**	**0.0023**	**0.0046**	0.12 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**120**	**0.25**	**410**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.004**	**0.006**	**0.01**	NA	NA	NA	NA
Total BTEX							**156**	**0.574**	**694**	0	0	0	0	0	0	0	**0.004**	**0.006**	**0.01**	**0.0256**	**0.0075**	**0.0182**	0
Volatile Organic Compounds	ug/kg																						
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	120 U
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	120 U
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																						
Carcinogenic PAHs																							
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**55 D**	**17**	**74**	**42**	**0.052 J**	**0.053 J**	**0.12 J**	**0.095 J**	**0.065 J**	0.34 U	0.33 U	**20**	NA	NA	NA	0.12 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**41 D**	**22**	**71**	**17 J**	**0.051 J**	0.39 U	**0.089 J**	**0.170 J**	0.41 U	0.34 U	0.33 U	**25**	NA	NA	NA	0.12 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**35 DJ**	**19**	**46**	**23 J**	**0.047 J**	**0.076 J**	**0.12 J**	**0.120 J**	0.41 U	0.34 U	0.33 U	**26**	NA	NA	NA	0.12 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**15**	**5.4**	**24 J**	**9.4**	0.39 U	**0.042 J**	**0.049 J**	**0.049 J**	0.41 U	0.34 U	0.33 U	**8**	NA	NA	NA	0.12 U
Chrysene		218-01-9	1	3.9	56	110	**52 D**	**17**	**81**	**29 J**	**0.064 J**	**0.087 J**	**0.15 J**	**0.110 J**	**0.089 J**	0.34 U	0.33 U	**19**	NA	NA	NA	0.12 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	**0.33 J**	**1.2 J**	42 U	**2.8 J**	0.39 U	0.39 U	0.38 U	0.41 U	0.41 U	0.34 U	0.33 U	**3.5 J**	NA	NA	NA	0.12 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**11**	**7.5**	**28 J**	**7.4**	0.39 U	**0.047 J**	**0.064 J**	**0.040 J**	0.41 U	0.34 U	0.33 U	**10**	NA	NA	NA	0.12 U
Total Carcinogenic PAHs							**209.33**	**89.1**	**324**	**130.6**	**0.214**	**0.305**	**0.592**	**0.584**	**0.154**	0	0	**111.5**	NA	NA	NA	0
Non-Carcinogenic PAHs																							
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**210 D**	**14**	**250**	**0.22 J**	0.39 U	0.39 U	0.38 U	0.41 U	0.41 U	0.34 U	0.33 U	3.5 U	NA	NA	NA	**0.36**
Acenaphthene		83-32-9	20	100	500	1000	**85 D**	**14**	**67**	0.34 U	0.39 U	0.39 U	0.38 U	0.41 U	0.41 U	0.34 U	0.33 U	**0.43 J**	NA	NA	NA	0.12 U
Acenaphthylene		208-96-8	100	100	500	1000	**13**	**3.3**	24 J	**6.4**	0.39 U	**0.1 J**	0.38 U	0.41 U	**0.049 J**	0.34 U	0.33 U	**10**	NA	NA	NA	**0.20**
Anthracene		120-12-7	100	100	500	1000	**74 D**	**12**	**140**	**4**	0.39 U	0.39 U	**0.043 J**	0.41 U	0.41 U	0.34 U	0.33 U	**4.4**	NA	NA	NA	**0.06 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**13**	**9.2**	35 J	**9.3**	0.39 U	**0.06 J**	**0.086 J**	**0.048 J**	0.41 U	0.34 U	0.33 U	**10**	NA	NA	NA	0.12 U
Fluoranthene		206-44-0	100	100	500	1000	**110 D**	**25**	**180**	**12 J**	**0.065 J**	**0.05 J**	**0.13 J**	**0.120 J**	**0.095 J**	0.34 U	0.33 U	**26**	NA	NA	NA	0.12 U
Fluorene		86-73-7	30	100	500	1000	**81 D**	**12**	**84**	**1.2 J**	0.39 U	0.39 U	0.38 U	0.41 U	0.41 U	0.34 U	0.33 U	3.5 U	NA	NA	NA	**0.07 J**
Naphthalene		91-20-3	12	100	500	1000	**350 D**	**30**	**540**	**0.12 J**	0.39 U	0.39 U	0.38 U	0.41 U	0.41 U	0.34 U	0.33 U	3.5 U	0.013 U	0.012 U	0.012 U	**1.33**
Phenanthrene		85-01-8	100	100	500	1000	**180 D**	**42 D**	**410**	**6**	**0.048 J**	0.39 U	**0.071 J**	**0.047 J**	0.41 U	0.34 U	0.33 U	**12**	NA	NA	NA	**0.18**
Pyrene		129-00-0	100	100	500	1000	**250 D**	**46 D**	**250**	**79**	**0.087 J**	**0.098 J**	**0.22 J**	**0.180 J**	**0.12 J**	0.34 U	0.33 U	**34**	NA	NA	NA	**0.04 J**
Total Non-Carcinogenic PAHs							**1366**	**207.5**	**1980**	**118.24**	**0.2**	**0.308**	**0.55**	**0.395**	**0.264**	0	0	**96.83**	0	0	0	**2.24**
Total PAHs							**1575.33**	**296.6**	**2304**	**248.84**	**0.414**	**0.613**	1.142	**0.979**	**0.418**	0	0	**208.33**	0	0	0	**2.24**
Other Semivolatile Organic Compounds	ug/lg																						
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.26**
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	13000 U	13000 U	13000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	**6000**	**2800**	**6400 J**	340 U	390 U	390 U	380 U	410 U	410 U	340 U	330 U	3500 U	NA	NA	NA	120 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																						
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**2.1**	**1.2**	**1.6**	**1.2**	**0.47 B**	**0.82 B**	**0.43 B**	**1.7**	**1.2**	NA	NA	NA	NA	NA	NA	NA	NA
Barium		7440-39-3	350	400	400	10000	**18.6**	**16.6 B**	**8.6 B**	**3.2 B**	**3.6 B**	**6.7 B**	**6.4 B**	**10.5**	**9.6 B**	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	**0.96**	**1.1**	**0.43 B**	0.19 U	0.23 U	0.2 U	0.23 U	0.21 U	**0.3 B**	NA	NA	NA	NA	NA	NA	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**1.8 B**	**2.6**	**4.2**	**1.4 B**	**2.7**	**2.5**	**3.3**	**4**	**8.2**	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**32.2**	**22.3**	**8.2**	**2**	**1 B**	**4.7**	**3.1**	**26.2**	**8.5**	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.017 U	**0.14**	**0.024 B**	0.052 U	0.057 U	0.047 U	0.059 U	0.058 U	0.054 U	NA	NA	NA	NA	NA	NA	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	**4.9**	**2**	0.43 U	0.38 U	0.45 U	0.4 U	0.45 U	0.43 U	0.42 U	NA	NA	NA	NA	NA	NA	NA	NA
Silver		7440-22-4	2	180	1500	6800	**0.46 B**	**3.7**	**0.4 B**	0.28 U	0.34 U	0.3 U	0.34 U	0.32 U	0.32 U	NA	NA	NA	NA	NA	NA	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																						
Cyanide, total		57-12-5	27	27	27	10,000	**3.2**	**0.16 B**	**0.062 B**	**0.8 B**	**0.87 B**	**0.11 B**	**2.8**	**0.94**	**0.97**	**6.7 ***	**2.7 ***	**0.94**	NA	NA	NA	NA

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	TP-12B	TP-22B	TP-23B	PZ-01	PZ-05	PZ-05	PZ-08	RPMW-07D2	RPSB-09	RPSB-10	RPSB-11	RPSB-119	RPSB-119	RPSB-12
							Sample Name	RPTP-12 (8-10)	RPTP22 (11.5-13)	RPTP-23 (10-11)	RP-SBO1-02	RP-SB03-01	RP-SB03-02	RP-SBO2-02	RPMW-0702 (23-24)	RPSB-09 (20-22)	RPSB-10 (18-20)	RPSB-11 (15-17)	RPSB-119 (14-17)	RPSBXX-082302-1	RPSB-12 (14-16)
							Start Depth	8	11.513	10	13.00	13.00	23.00	13.00	23	20	18	15	14	14	14
							End Depth	10	11.513	11	13.00	13.00	23.00	13.00	24	22	20	17	17	17 (Dup)	16
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	10/25/1995	10/26/1995	10/26/1995	10/24/1995	10/25/1995	10/25/1995	10/24/1995	08/14/2002	01/07/2000	12/28/1999	12/17/1999	08/23/2002	08/23/2002	12/27/1999
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**															
BTEX	mg/kg																				
Benzene		71-43-2	0.06	4.8	44	89		0.22 U	0.15 U	**0.15 J**	**2.54**	**25**	**15.5**	**87.3**	**1.2**	0.001 U	0.001 U	**5.7**	**15**	**13**	**490**
Ethyl benzene		100-41-4	1	41	390	780		**0.45**	**1.2**	**0.91**	**13.4**	**250**	**123**	**131**	**23**	**0.002**	0.001 U	**66**	**180**	**120**	**890**
Toluene		108-88-3	0.7	100	500	1000		**0.08 J**	**0.32**	**0.13 J**	**1.05**	16 U	**1.93**	**15.5**	0.54 UJ	**0.007**	0.001 U	1.2 U	2.9 U	1.2 U	**94**
Xylene (total)		1330-20-7	0.26	100	500	1000		**2.01**	0.006 U	**1.01**	**12.6**	NA	**150.2**	**234**	**8.1**	**0.019**	0.001 U	**36**	**120**	**94**	**1000**
Total BTEX								**2.54**	**0.011**	**2.2**	**29.59**	**275**	**290.63**	**467.8**	**32.3**	**0.028**	0	**107.7**	**315**	**227**	**2474**
Volatile Organic Compounds	ug/kg																				
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		NA	**6 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		**1500**	150 U	**1860**	**13100**	NA	**40100**	**118000**	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		**960**	**650**	**240**	140 U	16000 U	120 U	270 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		NA	6 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																				
Carcinogenic PAHs																					
Benzo(a)anthracene		56-55-3	1	1	5.6	11		**1.09**	**24.2**	**5.6**	**16.8**	**120 D**	**48**	**162**	**52**	**0.21 J**	**0.18 J**	**9.2 J**	**80 J**	**38 J**	**520 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1		**0.67**	**21.6**	**5.03**	**12.4**	**100 D**	**38.8**	**109**	**37**	**0.15 J**	**0.1 J**	**6.7 J**	**64 J**	**72 J**	**350 J**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		**0.26**	**8.52**	**2.22**	**4.88**	**43 JD**	**17.8**	**49.7**	**27**	**0.14 J**	**0.097 J**	**5.2 J**	**49 J**	**56 J**	**280 J**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		**0.45**	**12.7**	**3.07**	**7.83**	**60 JD**	**24.9**	**72.6**	**10 J**	**0.063 J**	**0.048 J**	**2 J**	**23 J**	**26 J**	**110 J**
Chrysene		218-01-9	1	3.9	56	110		**0.97**	**24.3**	**6.15**	**15.7**	**120 D**	**44.7**	**142**	**55**	**0.21 J**	**0.15 J**	**6.7 J**	**82 J**	**71 J**	**470 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.22 U	**2.32**	**0.93**	**1.24**	**84 U**	**4.03 J**	**12.6**	**3.5 J**	0.39 U	0.42 U	10 U	99 U	100 U	590 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		**0.14 J**	**8.73**	**6.68**	**4.23**	**33 JD**	**16.2**	**41.5**	**10 J**	**0.083 J**	0.42 U	**1.5 J**	**15 J**	**12 J**	**110 J**
Total Carcinogenic PAHs								**3.58**	**102.37**	**29.68**	**63.08**	**560**	**194.43**	**589.4**	**194.5**	**0.856**	**0.575**	**31.3**	**313**	**275**	**1840**
Non-Carcinogenic PAHs																					
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		**28.1**	**2.55**	**6.28**	**140**	**370 D**	**162**	**972**	**140**	**0.31 J**	**0.17 J**	**68**	**670**	**590**	**3300**
Acenaphthene		83-32-9	20	100	500	1000		**2.96**	**23.5**	**25.3**	**79.9**	**270 D**	**99.3**	**265**	**150**	**0.11 J**	**0.34 J**	**27**	**350**	**330**	**1800**
Acenaphthylene		208-96-8	100	100	500	1000		**8.22**	**8.56**	0.18 U	**6.57**	**22 JD**	**20.9**	**63.9**	**17 J**	**0.074 J**	**0.059 J**	**6.5 J**	**29 J**	**26 J**	**180 J**
Anthracene		120-12-7	100	100	500	1000		**3.36**	**37.3**	0.18 U	**29.4**	**170 D**	**66.2**	**180**	**86**	**0.26 J**	**0.18 J**	**15**	**180**	**160**	**900**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		**0.15 J**	**13.2**	**4.56 J**	**4.45**	**43 JD**	**21.0**	**46.6**	**13 J**	**0.092 J**	**0.05 J**	**1.7 J**	**16 J**	**15 J**	**130 J**
Fluoranthene		206-44-0	100	100	500	1000		**1.71**	**45.5**	**9.05**	**27.8**	**270 D**	**87.9**	**248**	**91**	**0.42**	**0.33 J**	**16**	**190**	**170**	**940**
Fluorene		86-73-7	30	100	500	1000		**5.05**	**42.1**	**17.1**	**43.3**	**190 D**	**60.1**	**249**	**120**	**0.22 J**	**0.22 J**	**21**	**240**	**220**	**1000**
Naphthalene		91-20-3	12	100	500	1000		**51.1**	**1.54**	0.18 U	**249**	**870 D**	**351**	**2580 E**	**280**	**0.42**	**0.5**	**170**	**1300**	**1100**	**6800**
Phenanthrene		85-01-8	100	100	500	1000		**10.8**	**139 E**	**15.0**	**108**	**670 D**	**224**	**758**	**250**	**0.98**	**0.73**	**62**	**650**	**570**	**3200**
Pyrene		129-00-0	100	100	500	1000		**2.59**	**70.3**	**27.1**	**46.7**	**350 D**	**127**	**376**	**160**	**0.61**	**0.6**	**26**	**280**	**250**	**1400**
Total Non-Carcinogenic PAHs								**114.04**	**383.55**	**104.39**	**735.12**	**3225**	**1219.4**	**5738.5**	**1307**	**3.496**	**3.179**	**413.2**	**3905**	**3431**	**19650**
Total PAHs								**117.62**	**485.92**	**134.07**	**798.2**	**3785**	**1413.83**	**6327.9**	**1501.5**	**4.352**	**3.754**	**444.5**	**4218**	**236**	**21490**
Other Semivolatile Organic Compounds	ug/lg																				
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE		**18.3**	**10.4**	**21.9**	**111**	NA	**97.7**	**556**	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	8600 U	NA	NA	84000 U	NA	NA	NA	12000 U	13000 U	12000 U	NA	NA	**23000**
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		**1090**	**6000**	**2430**	**5510**	**20000 JD**	**10800**	**26500**	**9500 J**	390 U	420 U	**1800 J**	**18000 J**	**16000 J**	**85000 J**
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	8600 U	NA	NA	84000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE		NA	NA	NA											
Metals	mg/kg																				
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		NA	NA	NA	NA	NA	NA	NA	NA	0.29 U	0.35 U	**1.6**	NA	NA	**4.4**
Barium		7440-39-3	350	400	400	10000		NA	NA	NA	NA	NA	NA	NA	NA	**1.4 B**	**1.3 B**	**12.9 B**	NA	NA	**4.7 B**
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		NA	NA	NA	NA	NA	NA	NA	NA	0.19 U	0.24 U	**0.21 B**	NA	NA	0.23 U
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	**1.3 B**	**0.92 B**	**3.4**	NA	NA	**2.9**
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		NA	NA	NA	NA	NA	NA	NA	NA	**1**	**0.64 B**	**7.8**	NA	NA	**19.6**
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		NA	NA	NA	NA	NA	NA	NA	NA	0.018 U	0.021 U	0.017 U	NA	NA	**0.041 B**
Nickel		7440-02-0	30	310	310	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		NA	NA	NA	NA	NA	NA	NA	NA	0.38 U	0.47 U	0.41 U	NA	NA	**0.48 B**
Silver		7440-22-4	2	180	1500	6800		NA	NA	NA	NA	NA	NA	NA	NA	0.29 U	0.35 U	**0.36 B**	NA	NA	**0.8 B**
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																				
Cyanide, total		57-12-5	27	27	27	10,000		NA	NA	NA	NA	NA	NA	NA	**0.41**	0.036 U	0.036 U	**0.12 B**	0.27 U	0.31 U	**2.5**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-121	RPSB-123	RPSB-124	RPSB-21	RPSB-23	RPSB-30	RPSB-31B	RPSB-67	RPSB-68	RPSB-69	RPSB-90	PZ-01	PZ-05	PZ-08
							Sample Name	RPSB-121 (20.5-21)	RPSB-123 (16-26)	RPSB-124 (17-27)	RPSB-21 (23-25)	RPSB-23 (12-14)	RPSB-30 (19-21)	RPSB-31B (22-24)	RPSB-67 (12-14)	RPSB-68 (14-16)	RPSB-69 (14-16)	RPSB-90 (16-18)	RP-SBO1-03	RP-SB03-03	RP-SB02-03
							Start Depth	20.5	16	17	23	12	19	22	12	14	14	16	36.00	38.50	39.00
							End Depth	21	26	27	25	14	21	24	14	16	16	18	36.00	38.50	39.00
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	08/15/2002	08/12/2002	08/19/2002	12/15/1999	01/04/2000	02/01/2000	01/12/2000	10/11/1999	10/11/1999	10/12/1999	11/02/2001	10/24/1995	10/25/1995	10/24/1995
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**															
BTEX	mg/kg																				
Benzene		71-43-2	0.06	4.8	44	89	**73**	2.8 UJ	0.001 U	0.001 U	**16**	**0.002 J**	0.001 U	0.001 U	0.001 U	**0.016**	0.001 U	**0.44**	**0.89**	**1.1**
Ethyl benzene		100-41-4	1	41	390	780	**380**	**180**	0.001 U	0.001 U	**150**	**0.011**	0.001 U	0.001 U	0.001 U	**0.062**	0.001 U	**0.79**	**7.77**	**6.2**
Toluene		108-88-3	0.7	100	500	1000	5.8 U	2.8 U	0.001 U	0.001 U	**21**	**0.001 J**	0.001 U	0.001 U	0.001 U	**0.14**	**0.001**	**0.12 J**	**0.35**	**0.78**
Xylene (total)		1330-20-7	0.26	100	500	1000	**340**	**220**	**0.002**	0.001 U	**240**	**0.004**	**0.004**	0.001 U	**0.002**	**0.079**	**0.01**	**0.68**	**8.4**	**12**
Total BTEX							**793**	**400**	**0.002**	0	**427**	**0.018**	**0.004**	0	**0.002**	**0.297**	**0.011**	**681.35**	**8409.01**	**20.08**
Volatile Organic Compounds	ug/kg																				
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000 U
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000 U
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000 U
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**350**	**3350**	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	800 U
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	800 U
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	800 U
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	290 U	130 U	800 U	
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	800 U
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	800 U
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																				
Carcinogenic PAHs																					
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**240 J**	**70**	0.38 U	0.4 U	**15 DJ**	**0.21 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**1.05**	**6.24**	**12 D**	
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**160 J**	**47 J**	0.38 U	0.4 U	**9 DJ**	**0.15 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**0.88**	**5.34**	**8 J**	
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**120 J**	**37 J**	0.38 U	0.4 U	**7.3 DJ**	**0.16 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**0.4**	**2.3**	**3.1 JD**	
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**50 J**	**18 J**	0.38 U	0.4 U	**3**	**0.055 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	0.55	**3.5**	**7.1 JD**	
Chrysene		218-01-9	1	3.9	56	110	**230 J**	**80**	0.38 U	0.4 U	**12 DJ**	**0.27 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**1.03**	**5.71**	**12 D**	
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	390 U	57 U	0.38 U	0.4 U	**2.1**	0.41 U	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	0.29 U	**0.57**	8 U	
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	390 U	**18 J**	0.38 U	0.4 U	**8.8 E**	0.41 U	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**0.26 J**	**2.29**	8 U	
Total Carcinogenic PAHs							**800**	**270**	0	0	**57.2**	**0.845**	0	0	0	0	0	**4.17**	**25.95**	**42.2**	
Non-Carcinogenic PAHs																					
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**1800**	**520**	0.38 U	0.4 U	**99 D**	**0.21 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**5.11**	**15.8**	**65 D**	
Acenaphthene		83-32-9	20	100	500	1000	**920**	**120**	0.38 U	0.4 U	**30 DJ**	**0.11 J**	0.39 U	0.41 U	0.38 U	0.42 U	**0.25 J**	**3.72**	**15.1**	**15 D**	
Acenaphthylene		208-96-8	100	100	500	1000	**68 J**	**26 J**	0.38 U	0.4 U	**5.5 DJ**	**0.07 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**0.51**	**2.49**	**3 J**	
Anthracene		120-12-7	100	100	500	1000	**370 J**	**84**	0.38 U	0.4 U	**21 DJ**	**0.42**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**1.58**	**8.55**	**14 D**	
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**43 J**	**20 J**	0.38 U	0.4 U	**9.3 E**	**0.067 J**	0.39 U	0.41 U	0.38 U	0.42 U	0.42 U	**0.32**	**2.80**	**3.3 JD**	
Fluoranthene		206-44-0	100	100	500	1000	**470**	**120**	0.38 U	0.4 U	**31 DJ**	**0.4 J**	**0.057 J**	0.41 U	0.38 U	0.42 U	**0.06 J**	**1.81**	**11.7**	**22 D**	
Fluorene		86-73-7	30	100	500	1000	**630**	**180**	0.38 U	0.4 U	**28 DJ**	**0.33 J**	0.39 U	0.41 U	0.38 U	0.42 U	**0.26 J**	**2.43**	**8.82**	**24 D**	
Naphthalene		91-20-3	12	100	500	1000	**4200**	**780**	0.38 U	0.4 U	**230 D**	**0.23 J**	0.39 U	0.41 U	**0.041 J**	**0.054 J**	0.42 U	**11.6**	**30.6**	**100 D**	
Phenanthrene		85-01-8	100	100	500	1000	**1800**	**400**	**0.054 J**	0.4 U	**96 D**	**1.1**	**0.096 J**	0.41 U	0.38 U	0.42 U	0.42 U	**5.89**	**31.0**	**72 D**	
Pyrene		129-00-0	100	100	500	1000	**730**	**220**	**0.049 J**	0.4 U	**42 DJ**	**0.72**	**0.085 J**	0.41 U	0.38 U	0.42 U	**0.076 J**	**2.90**	**16.7**	**32 D**	
Total Non-Carcinogenic PAHs							**11031**	**2470**	**0.103**	0	**591.8**	**3.657**	**0.238**	0	**0.041**	**0.054**	**0.646**	**35.87**	**143.56**	**350.3**	
Total PAHs							**11831**	**2740**	0.103	0	**649**	**4.502**	**0.238**	0	**0.041**	**0.054**	**0.646**	**40.04**	**169.51**	**392.5**	
Other Semivolatile Organic Compounds	ug/lg																				
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.6**	**13.5**	NA	
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	15000 U	12000 U	12000 U	13000 U	NA	NA	NA	NA	NA	NA	NA	8000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
Dibenzofuran		132-64-9	7000	59000	350000	1000000	**57000 J**	**19000 J**	380 U	400 U	**6900 E**	410 U	390 U	410 U	380 U	420 U	420 U	**340**	**1590**	**2100 JD**	
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8000 U
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE															
Metals	mg/kg																				
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	NA	NA	NA	0.31 U	**0.5 B**	0.3 U	0.24 U	**0.45 B**	**0.61 B**	**0.31 B**	NA	NA	NA	NA	NA
Barium		7440-39-3	350	400	400	10000	NA	NA	NA	**2 B**	**2.5 B**	**1.9 B**	**1.2 B**	**2.3 B**	**1.3 B**	**0.83 B**	NA	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	NA	NA	NA	0.21 U	0.24 U	0.2 U	0.16 U	0.21 U	0.23 U	0.2 U	NA	NA	NA	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	NA	NA	NA	**1 B**	**1.8 B**	**3.5**	**1.1 B**	**2.3**	**1.9 B**	**1.3 B**	NA	NA	NA	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	NA	NA	NA	**0.5 B**	**3.9**	**0.33 B**	**0.55 B**	**1.5**	**0.4 B**	0.3 U	NA	NA	NA	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	NA	NA	NA	0.018 U	0.019 U	0.02 U	0.018 U	0.055 U	0.05 U	0.053 U	NA	NA	NA	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	NA	NA	NA	0.42 U	**0.48 B**	0.4 U	0.32 U	0.41 U	0.46 U	0.4 U	NA	NA	NA	NA	NA
Silver		7440-22-4	2	180	1500	6800	NA	NA	NA	0.31 U	0.36 U	0.3 U	0.24 U	0.31 U	0.34 U	0.3 U	NA	NA	NA	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																				
Cyanide, total		57-12-5	27	27	27	10,000	0.29 U	**0.33 B**	0.24 UJ	**0.28 B**	0.06 U	0.093 U	**0.13 B**	**0.35 B**	**0.056 B**	**0.8 B**	**0.4 B***	NA	NA	NA	

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-09	RPSB-11	RPSB-118	RPSB-119	RPSB-120	RPSB-122	RPSB-124	RPSB-15	RPSB-15	RPSB-16	RPSB-17	RPSB-21	RPSB-23
						Sample Name	RPSB-09 (40-42)	RPSB-11 (40-42)	RPSB-118 (26-27)	RPSB-119 (40-47)	RPSB-120 (37-47)	RPSB-122 (27-37)	RPSB-124 (27-37)	RPSB-15 (25-27)	RPSB-15 (40-42)	RPSB-16 (30-32)	RPSB-17 (35-37)	RPSB-21 (39-41)	RPSB-23 (36-38)
						Start Depth	40	40	26	40	37	27	27	25	40	30	35	39	36
						End Depth	42	42	27	47	47	37	37	27	42	32	37	41	38
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	01/07/2000	12/17/1999	08/16/2002	08/23/2002	08/16/2002	08/19/2002	08/19/2002	12/15/1999	12/15/1999	12/07/1999	12/07/1999	12/15/1999	01/06/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**													
BTEX	mg/kg																		
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	0.001 U	**24**	**0.034**	**0.005**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.003**	0.001 U	**0.003**
Ethyl benzene		100-41-4	1	41	390	780	0.001 U	**0.042**	**270**	**0.03**	**0.025**	0.001 U	0.001 U	**0.002**	**0.001 J**	**0.017**	**0.014**	**0.001 J**	**0.007**
Toluene		108-88-3	0.7	100	500	1000	0.001 U	0.001 U	2.8 U	**0.002**	0.001 U	0.001 U	**0.001**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.001 J**
Xylene (total)		1330-20-7	0.26	100	500	1000	0.001 U	**0.022**	**270**	**0.005**	**0.004**	0.001 U	**0.002**	**0.002**	**0.001 J**	**0.016**	**0.021**	**0.005**	**0.01**
Total BTEX							0	**0.064**	**564**	**0.071**	**0.034**	0	**0.003**	**0.004**	**0.002**	**0.033**	**0.038**	**0.006**	**0.021**
Volatile Organic Compounds	ug/kg																		
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																		
Carcinogenic PAHs																			
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.41 U	**0.074 J**	**73 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	**0.052 J**	**0.085 J**	**0.046 J**	0.41 U	**0.17 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.41 U	**0.047 J**	**62 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.06 J**	0.4 U	0.41 U	**0.12 J**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.41 U	0.43 U	**43 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.048 J**	0.4 U	0.41 U	**0.1 J**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.41 U	0.43 U	**25 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	0.39 U	0.4 U	0.41 U	0.4 U
Chrysene		218-01-9	1	3.9	56	110	0.41 U	**0.062 J**	**75 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.078 J**	**0.045 J**	0.41 U	**0.14 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.41 U	0.43 U	97 U	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	0.39 U	0.4 U	0.41 U	0.4 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.41 U	0.43 U	**18 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	0.39 U	0.4 U	0.41 U	**0.042 J**
Total Carcinogenic PAHs							0	**0.183**	**296**	0	0	0	0	0	**0.052**	**0.271**	**0.091**	0	**0.572**
Non-Carcinogenic PAHs																			
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.41 U	**0.21 J**	**500**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.12 J**	**0.096 J**	0.41 U	**0.1 J**
Acenaphthene		83-32-9	20	100	500	1000	0.41 U	**0.22 J**	**260**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.24 J**	**0.099 J**	0.41 U	**0.098 J**
Acenaphthylene		208-96-8	100	100	500	1000	0.41 U	0.43 U	**34 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	0.39 U	0.4 U	0.41 U	**0.053 J**
Anthracene		120-12-7	100	100	500	1000	**0.042 J**	**0.11 J**	**120**	**0.066 J**	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.11 J**	**0.065 J**	0.41 U	**0.18 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.41 U	0.43 U	**21 J**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	0.39 U	0.4 U	0.41 U	0.4 U
Fluoranthene		206-44-0	100	100	500	1000	**0.1 J**	**0.17 J**	**180**	**0.056 J**	0.41 U	0.39 U	**0.07 J**	0.38 U	**0.08 J**	**0.18 J**	**0.14 J**	0.41 U	**0.29 J**
Fluorene		86-73-7	30	100	500	1000	0.41 U	**0.18 J**	**180**	0.41 U	0.41 U	0.39 U	0.4 U	0.38 U	0.42 U	**0.14 J**	**0.086 J**	0.41 U	**0.16 J**
Naphthalene		91-20-3	12	100	500	1000	0.41 U	**0.42 J**	**1300**	0.41 U	0.41 U	0.39 U	**0.072 J**	0.38 U	0.42 U	**0.25 J**	**0.18 J**	0.41 U	**0.12 J**
Phenanthrene		85-01-8	100	100	500	1000	**0.23 J**	**0.62**	**530**	**0.15 J**	**0.096 J**	0.39 U	**0.16 J**	**0.082 J**	**0.19 J**	**0.58**	**0.4**	**0.058 J**	**0.92**
Pyrene		129-00-0	100	100	500	1000	**0.15 J**	**0.25 J**	**240**	**0.079 J**	0.41 U	0.39 U	**0.094 J**	**0.07 J**	**0.16 J**	**0.3 J**	**0.2 J**	0.41 U	**0.62**
Total Non-Carcinogenic PAHs							**0.522**	**2.18**	**3365**	**0.351**	**0.096**	0	**0.396**	**0.152**	**0.43**	**1.92**	**1.266**	**0.058**	**2.541**
Total PAHs							**0.522**	**2.363**	**3661**	**0.351**	**0.096**	0	**0.396**	**0.152**	**0.482**	**2.191**	**1.357**	**0.058**	**3.113**
Other Semivolatile Organic Compounds	ug/lg																		
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	12000 U	12000 U	NA	NA	NA	NA	NA	15000 U	12000 U	15000 U	15000 U	15000 U	12000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	410 U	430 U	**21000 J**	410 U	410 U	390 U	400 U	380 U	420 U	390 U	400 U	410 U	400 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE													
Metals	mg/kg																		
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.67 B**	**0.72 B**	NA	NA	NA	NA	NA	**0.41 B**	**0.55 B**	0.36 U	**0.6 B**	**1**	**0.67 B**
Barium		7440-39-3	350	400	400	10000	**2.1 B**	**2 B**	NA	NA	NA	NA	NA	**1.7 B**	**2.1 B**	**1.9 B**	**2.6 B**	**1.7 B**	**1.5 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.22 U	0.19 U	NA	NA	NA	NA	NA	0.18 U	0.16 U	0.24 U	0.24 U	0.2 U	0.2 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**5.9**	**3**	NA	NA	NA	NA	NA	**1.3 B**	**1.9**	**2.1 B**	**2.8**	**2.5**	**2.8**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**0.79 B**	**0.52 B**	NA	NA	NA	NA	NA	**0.7 B**	**0.7 B**	**0.96 B**	**1.1 B**	**0.68 B**	**0.86 B**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.02 U	0.019 U	NA	NA	NA	NA	NA	0.019 U	0.016 U	0.019 U	0.02 U	0.017 U	0.02 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.44 U	0.38 U	NA	NA	NA	NA	NA	0.36 U	0.32 U	0.47 U	0.48 U	0.4 U	**0.86 B**
Silver		7440-22-4	2	180	1500	6800	0.33 U	0.29 U	NA	NA	NA	NA	NA	0.27 U	0.24 U	0.36 U	0.36 U	0.3 U	0.3 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																		
Cyanide, total		57-12-5	27	27	27	10,000	**0.088 B**	0.057 U	0.23 U	0.28 U	0.27 U	0.27 UJ	0.29 UJ	**0.13 B**	0.036 U	**0.11 B**	0.046 U	0.037 U	0.045 U

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-24	RPSB-27	RPSB-28	RPSB-29	RPSB-31A	RPSB-34	RPSB-36	RPSB-37	RPSB-38	RPSB-42	RPSB-45	RPSB-45	RPSB-46
							Sample Name	RPSB-24 (30-32)	RPSB-27 (40-42)	RPSB-28 (38-40)	RPSB-29 (35-37)	RPSB-31A (35-37)	RPSB-34 (40-42)	RPSB-36 (35-37)	RPSB-37 (35-37)	RPSB-38 (30-32)	RPSB-42 (35-37)	RPSB-45 (25-27)	RPSB-45 (40-42)	RPSB-46 (35-37)
							Start Depth	30	40	38	35	35	40	35	35	30	35	25	40	35
							End Depth	32	42	40	37	37	42	37	37	32	37	27	42	37
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	01/11/2000	12/17/1999	12/30/1999	02/03/2000	01/04/2000	12/29/1999	01/03/2000	01/12/2000	01/13/2000	01/24/2000	01/07/2000	01/07/2000	12/20/1999
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**														
BTEX	mg/kg																			
Benzene		71-43-2	0.06	4.8	44	89	**0.004**	0.001 U	**0.002**	**0.003**	0.006 U	**0.015**	0.001 U	**0.002**	**0.002**	**0.002**	0.012 U	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	**0.069**	0.001 U	0.001 U	**0.014**	**0.03**	**0.08**	**0.003**	**0.002**	**0.003**	0.001 U	**0.75**	**0.002**	0.001 U
Toluene		108-88-3	0.7	100	500	1000	**0.002**	0.001 U	0.001 U	**0.004**	0.006 U	**0.001**	0.001 U	**0.002**	**0.002**	**0.004**	0.012 U	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.033**	0.001 U	**0.003**	**0.032**	**0.05**	**0.1**	**0.002**	**0.005**	**0.006**	**0.003**	**0.68**	**0.004**	**0.001 J**
Total BTEX							**0.108**	0	**0.005**	**0.053**	**0.08**	**0.196**	**0.005**	**0.011**	**0.013**	**0.009**	**1.43**	**0.006**	**0.001**
Volatile Organic Compounds	ug/kg																		
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																		
Carcinogenic PAHs																			
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**0.097 J**	**0.099 J**	**0.048 J**	**0.25 J**	**1.3**	**1.5**	**0.37 J**	0.42 U	0.41 U	**0.18 J**	**3.1**	**0.47**	0.41 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**0.066 J**	**0.078 J**	0.4 U	**0.19 J**	**0.77 J**	**1.4**	**0.32 J**	0.42 U	0.41 U	**0.14 J**	**2.3**	**0.37 J**	0.41 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**0.057 J**	**0.056 J**	0.4 U	**0.15 J**	**0.61 J**	**1.2**	**0.27 J**	0.42 U	0.41 U	**0.12 J**	**1.6**	**0.3 J**	0.41 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.39 U	0.4 U	0.4 U	**0.06 J**	**0.22 J**	**0.66**	**0.13 J**	0.42 U	0.41 U	**0.052 J**	**0.84**	0.12 J	0.41 U
Chrysene		218-01-9	1	3.9	56	110	**0.087 J**	**0.096 J**	**0.042 J**	**0.24 J**	**0.98**	**1.3**	**0.32 J**	0.42 U	0.41 U	**0.17 J**	**2.4**	**0.41 J**	0.41 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.39 U	0.4 U	0.4 U	0.41 U	0.83 U	**0.097 J**	0.4 U	0.42 U	0.41 U	0.42 U	**0.23 J**	**0.047 J**	0.41 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.39 U	0.4 U	0.4 U	**0.057 J**	**0.26 J**	**0.25 J**	**0.068 J**	0.42 U	0.41 U	**0.049 J**	**0.85**	0.14 J	0.41 U
Total Carcinogenic PAHs							**0.307**	**0.329**	**0.09**	**0.947**	**4.14**	**6.407**	**1.478**	0	0	**0.711**	**11.32**	**1.857**	0
Non-Carcinogenic PAHs																			
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**0.22 J**	**0.37 J**	0.4 U	**0.34 J**	**5.9**	**3.4**	**0.65**	0.42 U	0.41 U	**0.15 J**	**3.1**	**1**	0.41 U
Acenaphthene		83-32-9	20	100	500	1000	**0.12 J**	**0.14 J**	0.4 U	**0.28 J**	**2.2**	**4**	**0.65**	0.42 U	0.41 U	**0.16 J**	**4.7**	**0.81**	0.41 U
Acenaphthylene		208-96-8	100	100	500	1000	**0.033 J**	**0.066 J**	0.4 U	**0.12 J**	**0.52 J**	**0.41 J**	**0.095 J**	0.42 U	0.41 U	**0.18 J**	**0.72**	**0.34 J**	0.41 U
Anthracene		120-12-7	100	100	500	1000	**0.095 J**	**0.12 J**	**0.056 J**	**0.39 J**	**1.5**	**3.2**	**0.54**	0.42 U	0.41 U	**0.25 J**	**4.2**	**0.7**	0.41 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.39 U	0.4 U	0.4 U	0.41 U	**0.37 J**	**0.3 J**	**0.078 J**	0.42 U	0.41 U	**0.064 J**	**0.96**	**0.16 J**	0.41 U
Fluoranthene		206-44-0	100	100	500	1000	**0.21 J**	**0.18 J**	**0.1 J**	**0.49**	**2.2**	**3.1**	**0.84**	0.42 U	**0.17 J**	**0.34 J**	**5.6**	**0.94**	**0.062 J**
Fluorene		86-73-7	30	100	500	1000	**0.16 J**	**0.18 J**	**0.044 J**	**0.4 J**	**2.4**	**2.3**	**0.5**	0.42 U	0.41 U	**0.22 J**	**3.4**	**0.78**	0.41 U
Naphthalene		91-20-3	12	100	500	1000	**0.35 J**	**0.22 J**	0.4 U	**0.13 J**	**7.4**	**6.7**	**0.74**	0.42 U	0.41 U	**0.17 J**	**5.1**	**0.91**	0.41 U
Phenanthrene		85-01-8	100	100	500	1000	**0.66**	**0.66**	**0.27 J**	**1.6**	**7.5**	**8.9 D**	**2.2**	**0.13 J**	**0.16 J**	**1**	**1.1 D**	**2.8**	**0.15 J**
Pyrene		129-00-0	100	100	500	1000	**0.3 J**	**0.31 J**	**0.14 J**	**0.8**	**3.4**	**4.8**	**1.3**	0.42 U	**0.28 J**	**0.57**	**7.7 D**	**1.3**	**0.1 J**
Total Non-Carcinogenic PAHs							**2.148**	**2.246**	**0.61**	**4.55**	**33.39**	**37.11**	**7.593**	**0.13**	**0.61**	**3.104**	**36.58**	**9.74**	**0.312**
Total PAHs							**2.455**	2.575	**0.7**	**5.497**	**37.53**	**43.517**	**9.071**	**0.13**	**0.61**	**3.815**	**47.9**	**11.597**	**0.312**
Other Semivolatile Organic Compounds	ug/lg																		
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	13000 U	12000 U	14000 U	13000 U	12000 U	14000 U	14000 U	13000 U	12000 U	13000 U	12000 U	12000 U	15000 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	390 U	400 U	400 U	**47 J**	**260 J**	**280 J**	**55 J**	420 U	410 U	420 U	**390**	**77 J**	410 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE													
Metals	mg/kg																		
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.96 B**	**1 B**	**0.85 B**	0.42 U	**0.84 B**	**0.84 B**	**0.9 B**	0.37 U	**1.2**	**0.74 B**	0.25 U	**0.7 B**	**1.2**
Barium		7440-39-3	350	400	400	10000	**5 B**	**1.8 B**	**2.7 B**	**1.6 B**	**3.7 B**	**1.9 B**	**5.3 B**	**1.9 B**	**2.1 B***	**2.4 B**	**1.9 B**	**2.9 B**	**3.8 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.19 U	0.22 U	0.18 U	**0.065 B**	0.21 U	0.24 U	0.18 U	0.24 U	**0.23 B**	0.26 U	0.16 U	0.23 U	0.22 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**4.2**	**1.6 B**	**2**	**2 B**	**1.7 B**	**2.6**	**2.6**	**2.3 B**	**2.1**	**2.3 B**	**1.8**	**2.1 B**	**2.4**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**0.8 B**	**0.99 B**	**0.55 B**	**0.43 B***	**1.2**	**0.47 B**	**0.63 B**	**0.9 B**	**1.6 ***	**0.98 B**	**0.62 B**	**0.83 B**	**0.87 B**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.019 U	0.018 U	0.02 U	0.019 U	0.018 U	0.021 U	0.02 U	0.021 U	0.019 U	0.018 U	0.016 U	0.018 U	0.018 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.39 U	0.43 U	0.36 U	0.42 U	0.43 U	0.48 U	0.36 U	0.49 U	0.3 U	0.98 B	0.33 U	1.2 B	0.44 U
Silver		7440-22-4	2	180	1500	6800	0.29 U	0.32 U	0.27 U	0.21 U	0.32 U	0.36 U	0.27 U	0.37 U	0.23 U	0.38 U	0.25 U	0.34 U	**0.47 B**
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																		
Cyanide, total		57-12-5	27	27	27	10,000	**0.049 B**	0.043 U	0.047 U	0.081 U	**0.05 B**	0.038 U	0.05 U	**0.28 B**	**0.17 B**	**0.24 B**	0.042 U	0.049 U	**0.82**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-49	RPSB-50	RPSB-50	RPSB-51	RPSB-91	RPMW-07D2	RPMW-08D2	RPSB-10	RPSB-10	RPSB-11	RPSB-118	RPSB-12	RPSB-120
						Sample Name	RPSB-49 (40-42)	RBSB-50 (39-41)	RBSB-50 (39-41)	RPSB-51 (40-42)	RPSB91 (28-30)	RPMW-0702 (68-69)	RPMW-08D2 (52-57)	RPSB-10 (50-52)	RPSB-10 (65-67)	RPSB-11 (45-47)	RPSB-118 (57-67)	RPSB-12 (50-52)	RPSB-120 (63.5-6)
						Start Depth	40	39	39	40	28	68	52	50	65	45	57	50	63.5
						End Depth	42	41	41	42	30	69	57	52	67	47	67	52	67
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	12/08/1999	12/10/1999	12/10/1999	01/11/2000	11/01/2001	08/14/2002	08/22/2002	12/28/1999	12/29/1999	12/17/1999	08/16/2002	12/27/1999	08/16/2002
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**													
BTEX	mg/kg																		
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	NA	**0.002**	0.001 U	0.001 U	0.61 U	**0.003**	**0.031**	**0.002**	0.001 U	**0.14 D**	0.001 U	**0.012**
Ethyl benzene		100-41-4	1	41	390	780	**0.004**	NA	**0.002**	**0.002**	0.001 U	**46**	**0.002**	**0.013**	0.001 U	**0.045**	**0.048**	0.001 U	**0.012**
Toluene		108-88-3	0.7	100	500	1000	**0.002**	NA	**0.002**	0.001 U	0.001 U	**1.2**	**0.002**	**0.002**	0.001 U	0.001 U	**0.013**	0.001 U	**0.002**
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.01**	NA	**0.01**	**0.002**	**0.002**	**57**	**0.003**	**0.019**	**0.004**	**0.024**	**0.059**	0.001 U	**0.015**
Total BTEX							**0.016**	NA	**0.016**	**0.004**	**0.002**	**104.2**	**0.01**	**0.065**	**0.006**	**0.069**	**0.26**	0	**0.041**
Volatile Organic Compounds	ug/kg																		
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																		
Carcinogenic PAHs																			
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**0.32 J**	NA	0.41 U	**0.75**	0.4 U	**110**	0.41 U	**0.06 J**	**0.058 J**	**0.044 J**	0.41 U	0.4 U	0.4 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**0.25 J**	NA	0.41 U	**0.71**	0.4 U	**81**	0.41 U	0.4 U	0.42 U	0.43 U	0.41 U	0.4 U	0.4 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**0.18 J**	NA	0.41 U	**0.54**	0.4 U	**65**	0.41 U	0.4 U	0.42 U	0.43 U	0.41 U	0.4 U	0.4 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**0.11 J**	NA	0.41 U	**0.26 J**	0.4 U	**25 J**	0.41 U	0.4 U	0.42 U	0.43 U	0.41 U	0.4 U	0.4 U
Chrysene		218-01-9	1	3.9	56	110	**0.29 J**	NA	0.41 U	**0.73**	0.4 U	**130**	0.41 U	**0.043 J**	**0.043 J**	0.43 U	0.41 U	0.4 U	0.4 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.42 U	NA	0.41 U	**0.069 J**	0.4 U	**8.6 J**	0.41 U	0.4 U	0.42 U	0.43 U	0.41 U	0.4 U	0.4 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**0.086 J**	NA	0.41 U	**0.3 J**	0.4 U	**28 J**	0.41 U	0.4 U	0.42 U	0.43 U	0.41 U	0.4 U	0.4 U
Total Carcinogenic PAHs							**1.236**	NA	0	**3.359**	**0**	**447.6**	0	**0.103**	**0.101**	**0.044**	0	0	0
Non-Carcinogenic PAHs																			
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.42 U	NA	0.41 U	**0.46**	0.4 U	**450**	0.41 U	**0.052 J**	0.42 U	**0.12 J**	0.41 U	0.4 U	0.4 U
Acenaphthene		83-32-9	20	100	500	1000	**0.57**	NA	0.41 U	**0.48**	**0.053 J**	**44 J**	0.41 U	**0.13 J**	**0.078 J**	**0.15 J**	0.41 U	**0.044 J**	0.4 U
Acenaphthylene		208-96-8	100	100	500	1000	**0.11 J**	NA	0.41 U	**0.24 J**	0.4 U	**400**	0.41 U	**0.029 J**	0.42 U	**0.031 J**	0.41 U	0.4 U	0.4 U
Anthracene		120-12-7	100	100	500	1000	**0.57**	NA	0.41 U	**1**	**0.041 J**	**210**	0.41 U	**0.11 J**	**0.062 J**	**0.085 J**	0.41 U	**0.041 J**	0.4 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**0.096 J**	NA	0.41 U	**0.37 J**	0.4 U	**30 J**	0.41 U	0.4 U	0.42 U	0.43 U	0.41 U	0.4 U	0.4 U
Fluoranthene		206-44-0	100	100	500	1000	**0.67**	NA	0.41 U	**1.7**	**0.051 J**	**220**	0.41 U	**0.18 J**	**0.1 J**	**0.1 J**	0.41 U	**0.062 J**	0.4 U
Fluorene		86-73-7	30	100	500	1000	**0.49**	NA	0.41 U	**0.77**	0.4 U	**310**	0.41 U	**0.13 J**	**0.061 J**	**0.12 J**	0.41 U	0.4 U	0.4 U
Naphthalene		91-20-3	12	100	500	1000	**0.058 J**	NA	0.41 U	**0.38 J**	**0.058 J**	**920**	0.41 U	**0.27 J**	0.42 U	**0.29 J**	0.41 U	**0.046 J**	0.4 U
Phenanthrene		85-01-8	100	100	500	1000	**1.9**	NA	**0.076 J**	**4**	**0.17 J**	**640**	**0.07 J**	**0.59**	**0.3 J**	**0.4 J**	**0.085 J**	**0.18 J**	0.4 U
Pyrene		129-00-0	100	100	500	1000	**0.97**	NA	**0.045 J**	**2.3**	**0.087 J**	**360**	0.41 U	**0.25 J**	**0.16 J**	**0.17 J**	**0.041 J**	**0.1 J**	0.4 U
Total Non-Carcinogenic PAHs							**5.434**	NA	**0.121**	**11.7**	**0.46**	**3584**	**0.07**	**1.741**	**0.761**	**1.466**	**0.126**	**0.473**	0
Total PAHs							**6.67**	NA	**0.121**	**15.059**	**0.46**	**4031.6**	**0.07**	**1.844**	**0.862**	**1.51**	**0.126**	**0.473**	0
Other Semivolatile Organic Compounds	ug/g																		
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	13000 U	11000 U	NA	13000 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	**52 J**	NA	410 U	**47 J**	400 U	**24000 J**	410 U	400 U	420 U	430 U	410 U	400 U	400 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE													
Metals	mg/kg																		
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.66 B**	NA	**1 B**	**0.91 B**	NA	NA	NA	**0.64 B**	0.35 U	**0.92 B**	NA	**0.67 B**	NA
Barium		7440-39-3	350	400	400	10000	**2.7 B**	NA	**8.9 B**	**1.3 B**	NA	NA	NA	**2.3 B**	**26**	**2.2 B**	NA	**1.6 B**	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.19 U	NA	0.23 U	0.21 U	NA	NA	NA	0.2 U	**0.25 B**	0.23 U	NA	0.21 U	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**5.4**	NA	**4.6**	**2.3**	NA	NA	NA	**1.9 B**	**7.6**	**2 B**	NA	**1.7 B**	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**1**	NA	**0.63 B**	**0.61 B**	NA	NA	NA	**0.32 B**	**3**	**0.53 B**	NA	**0.51 B**	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.022 U	NA	0.02 U	0.019 U	NA	NA	NA	0.019 U	0.02 U	0.02 U	NA	0.021 U	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.38 U	NA	0.47 U	**0.68 B**	NA	NA	NA	0.4 U	**3.3**	0.45 U	NA	0.41 U	NA
Silver		7440-22-4	2	180	1500	6800	0.29 U	NA	**0.5 B**	0.32 U	NA	NA	NA	0.3 U	0.35 U	0.34 U	NA	0.31 U	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																		
Cyanide, total		57-12-5	27	27	27	10,000	**0.29 B**	NA	0.049 U	**0.075 B**	7 U	0.29 U	0.27 U	0.032 U	0.033 UN	**0.11 B**	0.30 U	0.034 U	0.3 U

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-121	RPSB-122	RPSB-123	RPSB-124	RPSB-16	RPSB-17	RPSB-18	RPSB-18	RPSB-22	RPSB-22	RPSB-23	RPSB-24	RPSB-28
							Sample Name	RPSB-121 (67-71)	RPSB-122 (74-77)	RPSB-123 (80-86)	RPSB-124 (67-77)	RPSB-16 (50-52)	RPSB-17 (50-52)	RPSB-18 (80-82)	RPSB-18 (85-87)	RPSB-22 (60-62)	RPSB-22 (80-82)	RPSB-23 (48-50)	RPSB-24 (50-52)	RPSB-28 (48-50)
							Start Depth	67	74	80	67	50	50	80	85	60	80	48	50	48
							End Depth	71	77	86	77	52	52	82	87	62	82	50	52	50
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	08/15/2002	08/19/2002	08/13/2002	08/19/2002	12/07/1999	12/08/1999	12/09/1999	12/09/1999	12/02/1999	12/02/1999	01/06/2000	01/11/2000	12/30/1999
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**													
BTEX	mg/kg																		
Benzene		71-43-2	0.06	4.8	44	89	**0.017**	0.001 U	0.063 U	0.001 U	0.001 U	0.001 U	**0.005**	**0.025**	**9**	**0.016**	0.001 U	**0.001 J**	**0.012**
Ethyl benzene		100-41-4	1	41	390	780	**0.016**	0.001 U	**0.092**	0.001 U	0.001 U	**0.002**	**0.004**	**0.019**	**18**	**0.005**	**0.008**	**0.003**	**0.002**
Toluene		108-88-3	0.7	100	500	1000	0.001 U	0.001 U	0.063 U	0.001 U	0.001 U	**0.002**	**0.002**	**0.002**	**11**	**0.016**	0.001 U	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.058**	0.001 U	**1.6**	0.001 U	0.001 U	**0.009**	**0.012**	**0.013**	**49**	**0.032**	**0.017**	**0.005**	0.001 U
Total BTEX							**0.091**	0	**1.692**	0	0	**0.013**	**0.023**	**0.059**	**87**	**0.069**	**0.025**	**0.009**	**0.014**
Volatile Organic Compounds	ug/kg																		
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																		
Carcinogenic PAHs																			
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.43 U	0.42 U	**18**	0.39 U	**0.087 J**	**0.33 J**	**0.2 J**	0.41 U	**200 DJ**	**0.1 J**	**0.14 J**	**0.075 J**	**0.078 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.43 U	0.42 U	**14**	0.39 U	**0.065 J**	**0.24 J**	**0.15 J**	0.41 U	**170 DJ**	**0.075 J**	**0.1 J**	**0.06 J**	**0.053 J**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.43 U	0.42 U	**11 J**	0.39 U	**0.053 J**	**0.23 J**	**0.13 J**	0.41 U	**120 DJ**	**0.053 J**	**0.079 J**	**0.051 J**	0.41 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.43 U	0.42 U	**5.7 J**	0.39 U	0.39 U	**0.1 J**	**0.053 J**	0.41 U	**65 D**	0.44 U	0.04 J	0.33 U	0.41 U
Chrysene		218-01-9	1	3.9	56	110	0.43 U	0.42 U	**20**	0.39 U	**0.07 J**	**0.32 J**	**0.18 J**	0.41 U	**180 DJ**	**0.087 J**	**0.13 J**	**0.074 J**	**0.075 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.43 U	0.42 U	**1.3 J**	0.39 U	0.39 U	0.4 U	0.4 U	0.41 U	**19**	0.44 U	0.41 U	0.33 U	0.41 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.43 U	0.42 U	**5.3 J**	0.39 U	0.39 U	**0.083 J**	0.4 U	0.41 U	**61 DJ**	0.44 U	**0.042 J**	0.33 U	0.41 U
Total Carcinogenic PAHs							0	0	**75.3**	0	**0.275**	**1.303**	**0.713**	0	**815**	**0.315**	**0.531**	**0.26**	**0.206**
Non-Carcinogenic PAHs																			
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.43 U	0.42 U	**89**	0.39 U	0.39 U	0.4 U	**0.44**	0.41 U	**1100 D**	**0.2 J**	**0.16 J**	**0.095 J**	0.41 U
Acenaphthene		83-32-9	20	100	500	1000	**0.16 J**	0.42 U	**5.5 J**	0.39 U	**0.087 J**	**0.13 J**	**0.31 J**	0.41 U	**66 DJ**	**0.017 J**	**0.15 J**	**0.082 J**	**0.091 J**
Acenaphthylene		208-96-8	100	100	500	1000	0.43 U	0.42 U	**56**	0.39 U	0.39 U	**0.16 J**	**0.14 J**	0.41 U	**650 D**	**0.2 J**	**0.1 J**	0.33 U	0.41 U
Anthracene		120-12-7	100	100	500	1000	**0.1 J**	0.42 U	**32**	0.39 U	**0.1 J**	**0.33 J**	**0.27 J**	0.41 U	**320 DJ**	**0.13 J**	**0.16 J**	**0.082 J**	**0.11 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.43 U	0.42 U	**6.5 J**	0.39 U	0.39 U	**0.11 J**	**0.048 J**	0.41 U	**75 DJ**	0.44 U	**0.044 J**	0.33 U	0.41 U
Fluoranthene		206-44-0	100	100	500	1000	**0.099 J**	0.42 U	**37**	0.39 U	**0.16 J**	**0.56**	**0.38 J**	0.41 U	**470 D**	**0.2 J**	**0.32 J**	**0.16 J**	**0.16 J**
Fluorene		86-73-7	30	100	500	1000	**0.071 J**	0.42 U	**38**	0.39 U	**0.084 J**	**0.21 J**	**0.4 J**	0.41 U	**390 DJ**	**0.16 J**	**0.26 J**	**0.1 J**	**0.087 J**
Naphthalene		91-20-3	12	100	500	1000	**0.14 J**	0.42 U	**180**	0.39 U	0.39 U	0.4 U	**0.21 J**	0.41 U	**3400 D**	**0.53**	**0.07 J**	**0.065 J**	0.41 U
Phenanthrene		85-01-8	100	100	500	1000	**0.5**	0.42 U	**100**	0.39 U	**0.49**	**1.4**	**1.4**	**0.054 J**	**1200 D**	**0.56**	**1.1**	**0.47**	**0.44**
Pyrene		129-00-0	100	100	500	1000	**0.13 J**	0.42 U	**61**	0.39 U	**0.26 J**	**1.1**	**0.76**	0.41 U	**510 D**	**0.25 J**	**0.45**	**0.22 J**	**0.23 J**
Total Non-Carcinogenic PAHs							**1.2**	0	**605**	0	**1.181**	**4**	**4.358**	**0.054**	**8181**	**2.247**	**2.814**	**1.274**	**1.118**
Total PAHs							**1.2**	0	**680.3**	0	**1.456**	**5.303**	**5.071**	**0.054**	**8996**	**2.562**	**3.345**	**1.534**	**1.324**
Other Semivolatile Organic Compounds	ug/g																		
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	430 U	420 U	**4200 J**	390 U	390 U	400 U	400 U	410 U	**42000 DJ**	440 U	410 U	330 U	410 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE													
Metals	mg/kg																		
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	NA	NA	NA	NA	**0.54 B**	**0.55 B**	**0.56 B**	**0.64 B**	**0.55 B**	**0.52 B**	**0.64 B**	**0.76 B**	**0.72 B**
Barium		7440-39-3	350	400	400	10000	NA	NA	NA	NA	**2.9 B**	**17.9 B**	**20.4 B**	**47.6**	**7.5 B**	**30.5**	**2.9 B**	**1.7 B**	**2.7 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	NA	NA	NA	NA	0.2 U	**0.24 B**	**0.82**	**1.4**	**0.38 B**	**0.94**	0.22 U	0.24 U	0.22 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	NA	NA	NA	NA	**5.5**	**2.3**	**7.7**	**15.7**	**4.8**	**9.3**	**2.3**	**3.2**	**1.6 B**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	NA	NA	NA	NA	**1.1**	**9.2**	**3.6**	**5.5**	**1.3**	**3.5**	**0.74 B**	**0.74 B**	**0.52 B**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	NA	NA	NA	NA	0.019 U	0.02 U	**0.046 B**	**0.026 B**	0.02 U	0.019 U	0.02 U	0.019 U	0.02 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	NA	NA	NA	NA	0.4 U	0.43 U	0.46 U	0.49 U	**1 B**	**2.9**	**0.7 B**	**0.5 B**	**0.58 B**
Silver		7440-22-4	2	180	1500	6800	NA	NA	NA	NA	0.3 U	**0.5 B**	**0.68 B**	**0.9 B**	**0.35 B**	**0.67 B**	0.34 U	0.36 U	0.33 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																		
Cyanide, total		57-12-5	27	27	27	10,000	0.31 U	0.30 UJ	0.26 U	0.27 UJ	0.046 U	**0.18 B**	0.06 U	0.044 U	**0.047 B**	**0.081 B**	0.058 U	**0.1 B**	0.052 U

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-29	RPSB-30	RPSB-31B	RPSB-34	RPSB-35	RPSB-35	RPSB-36	RPSB-37	RPSB-38	RPSB-41	RPSB-43	RPSB-44	RPSB-45
							Sample Name	RPSB-29 (55-57)	RPSB-30 (60-62)	RPSB-31B(48-50)	RPSB-34 (80-82)	RPSB-35 (60-62)	RPSB-35 (80-82)	RPSB-36 (55-57)	RPSB-37 (50-52)	RPSB-38 (50-52)	RPSB-41 (45-47)	RPSB-43 (45-47)	RPSB-44 (65-67)	RPSB-45 (50-52)
							Start Depth	55	60	48	80	60	80	55	50	50	45	45	65	50
							End Depth	57	62	50	82	62	82	57	52	52	47	47	67	52
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	02/02/2000	02/02/2000	01/13/2000	12/30/1999	01/03/2000	01/04/2000	01/04/2000	01/12/2000	01/13/2000	12/16/1999	12/02/1999	12/06/1999	01/07/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**														
BTEX	mg/kg																			
Benzene		71-43-2	0.06	4.8	44	89	0.28 U	**0.002**	**0.002**	**0.001**	**0.006**	**0.022**	**0.001**	**0.002**	0.001 U	0.001 U	0.062 U	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	**4.7**	0.001 U	**0.003**	**0.001**	**0.2**	**0.006**	**0.002**	**0.004**	**0.002**	0.001 U	**0.12**	**0.001 J**	0.001 U
Toluene		108-88-3	0.7	100	500	1000	**0.44**	0.001 U	**0.002**	0.001 U	**0.11**	**0.013**	0.001 U	**0.003**	**0.002**	0.001 U	0.062 U	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**15**	0.001 U	**0.006**	0.001 U	**0.3**	**0.11**	0.001 U	**0.009**	**0.006**	**0.002**	**0.22**	**0.003**	0.001 U
Total BTEX							**20.14**	**0.002**	**0.013**	**0.002**	**0.616**	**0.151**	**0.003**	**0.018**	**0.01**	**0.002**	**0.34**	**0.004**	0
Volatile Organic Compounds	ug/kg																		
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																		
Carcinogenic PAHs																			
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**64 J**	0.39 U	**0.19 J**	**0.17 J**	**7**	**0.075 J**	**0.093 J**	0.39 U	0.41 U	0.39 U	**4.2**	**0.36 J**	0.41 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**49 J**	0.39 U	**0.092 J**	**0.14 J**	**6.9**	**0.043 J**	**0.043 J**	0.39 U	0.41 U	0.39 U	**2.8**	**0.29 J**	0.41 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**37 J**	0.39 U	**0.12 J**	**0.12 J**	**4.8**	0.42 U	0.4 U	0.39 U	0.41 U	0.39 U	**2.3**	**0.24 J**	0.41 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**10 J**	0.39 U	**0.042 J**	**0.059 J**	**2.9 J**	0.42 U	0.4 U	0.39 U	0.41 U	0.39 U	**0.89**	**0.068 J**	0.41 U
Chrysene		218-01-9	1	3.9	56	110	**58 J**	0.39 U	**0.19 J**	**0.16 J**	**6.4**	**0.07 J**	**0.057 J**	0.39 U	0.41 U	0.39 U	**4.4**	**0.33 J**	0.41 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	75 U	0.39 U	0.41 U	0.4 U	3.8 U	0.42 U	0.4 U	0.39 U	0.41 U	0.39 U	**0.21 J**	0.39 U	0.41 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**17 J**	0.39 U	**0.044 J**	0.4 U	**1.5 J**	0.42 U	0.4 U	0.39 U	0.41 U	0.39 U	**0.79**	**0.1 J**	0.41 U
Total Carcinogenic PAHs							**235**	0	**0.678**	**0.649**	**29.5**	**0.188**	**0.193**	0	0	0	**15.59**	**1.388**	0
Non-Carcinogenic PAHs																			
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**510**	0.39 U	**0.056 J**	**0.13 J**	**37**	**0.14 J**	0.4 U	0.39 U	0.41 U	**0.064 J**	**26 D**	**0.24 J**	0.41 U
Acenaphthene		83-32-9	20	100	500	1000	**190**	0.39 U	**0.15 J**	**0.11 J**	**2.8 J**	0.42 U	0.4 U	0.39 U	0.41 U	0.39 U	**6**	**0.62**	0.41 U
Acenaphthylene		208-96-8	100	100	500	1000	**51 J**	0.39 U	**0.064 J**	**0.14 J**	**14**	**0.14 J**	0.4 U	0.39 U	0.41 U	**0.059 J**	**6.3**	**0.43**	0.41 U
Anthracene		120-12-7	100	100	500	1000	**110**	0.39 U	**0.17 J**	**0.24 J**	**13**	**0.16 J**	**0.088 J**	0.39 U	0.41 U	**0.063 J**	**6.5**	**0.52**	**0.045 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**18 J**	0.39 U	**0.044 J**	0.4 U	**1.8 J**	0.42 U	0.4 U	0.39 U	0.41 U	0.39 U	**0.83**	**0.12 J**	0.41 U
Fluoranthene		206-44-0	100	100	500	1000	**120**	0.39 U	**0.54**	**0.4**	**14**	**0.21 J**	**0.18 J**	0.39 U	0.41 U	**0.059 J**	**10 D**	**0.68**	**0.075 J**
Fluorene		86-73-7	30	100	500	1000	**150**	0.39 U	**0.2 J**	**0.19 J**	**13**	**0.12 J**	**0.043 J**	0.39 U	0.41 U	**0.068 J**	**11 D**	**0.56**	0.41 U
Naphthalene		91-20-3	12	100	500	1000	**1200**	0.39 U	0.41 U	**0.2 J**	**92 D**	**0.42 J**	**0.047 J**	0.39 U	0.41 U	**0.043 J**	**49 D**	**0.44**	0.41 U
Phenanthrene		85-01-8	100	100	500	1000	**430**	0.39 U	**0.83**	**1**	**44**	**0.44**	**0.38 J**	0.39 U	**0.054 J**	**0.26 J**	**30 D**	**2.2**	**0.22 J**
Pyrene		129-00-0	100	100	500	1000	**200**	0.39 U	**0.48**	**0.55**	**24**	**0.4 J**	**0.27 J**	0.39 U	0.41 U	**0.15 J**	**12 D**	**1.1**	**0.11 J**
Total Non-Carcinogenic PAHs							**2979**	0	**2.534**	**2.96**	**255.6**	**2.03**	**1.008**	0	**0.054**	**0.766**	**157.63**	**6.91**	**0.45**
Total PAHs							**3214**	0	**3.212**	**3.609**	**285.1**	**2.218**	**1.201**	0	**0.054**	**0.766**	**173.22**	**8.298**	**0.45**
Other Semivolatile Organic Compounds	ug/lg																		
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	**15000 J**	390 U	**130 J**	400 U	**1400 J**	420 U	400 U	390 U	410 U	390 U	**1100**	**60 J**	410 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE													
Metals	mg/kg																		
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**1.1 B**	**0.72 B**	**0.4 B**	**1.8 B**	**0.63 B**	**1.4**	**0.89 B**	**0.32 B**	**0.61 B**	**1.8**	**0.83 B**	**0.57 B**	**0.64 B**
Barium		7440-39-3	350	400	400	10000	**2.4 B**	**1.8 B**	**1.7 B**	**61.1 E**	**2.4 B**	**14.4 B**	**1.7 B**	**1.5 B**	**2.1 B***	**39.3**	**2.4 B**	**2.7 B**	**1.3 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	**0.13 B**	**0.093 B**	0.18 U	**0.35 B**	0.2 U	**0.62**	0.24 U	0.21 U	0.21 U	0.29 U	**0.46 B**	**0.18 B**	0.22 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**2.2**	**2.1**	**3.4**	**18.2**	**4.2**	**7.8**	**2.5**	**2.4**	**2 B**	**1.7 B**	**4.5**	**3**	**2.2 B**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	0.19 U	0.23 U	**0.91**	**1.8**	0.3 U	**1.9**	**0.97 B**	**0.87 B**	**1.5 ***	**4.8**	**1**	**1**	**0.68 B**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.017 U	0.019 U	0.02 U	0.02 U	0.016 U	0.02 U	0.021 U	0.019 U	0.018 U	0.025 U	0.019 U	0.018 U	0.02 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.33 U	0.4 U	0.35 U	**0.55 B**	0.4 U	**0.51 B**	0.47 U	0.42 U	0.43 U	0.59 U	0.39 U	0.35 U	0.44 U
Silver		7440-22-4	2	180	1500	6800	**0.26 B**	**0.31 B**	0.27 U	**2 B**	0.3 U	**1.6 B**	0.35 U	0.31 U	0.32 U	0.44 U	0.29 U	0.27 U	0.33 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																		
Cyanide, total		57-12-5	27	27	27	10,000	0.066 U	0.083 U	**0.21 B**	0.045 U	0.055 U	0.061 U	0.053 U	**0.27 B**	**0.18 B**	**0.62 B**	**0.091 B**	0.055 U	0.051 U

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-46	RPSB-49	RPSB-50	RPSB-51	RPMW-07D2	RPMW-08D2	RPSB-119	RPSB-121	RPSB-123	RPSB-123	RPSB-123	RPSB-29
						Sample Name	RPSB-46 (50-52)	RPSB-49 (50-52)	RPSB-50 (55-57)	RPSB-51 (50-52)	RPMW-0702 (97-107)	RPMW-08D2 (97-107)	RPSB119 (87-97)	RPSB-121 (117-127)	RPSB-123 (100-104.5)	RPSB-123 (116-121)	RPSB-123 (141-146)	RPSB-29 (134-136)
						Start Depth	50	50	55	50	97	97	87.00	117	100	116	141	134
						End Depth	52	52	57	52	107	107	97.00	127	104.5	121	146	136
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	12/20/1999	12/08/1999	12/13/1999	01/11/2000	08/14/2002	08/22/2002	8/23/2002	08/15/2002	08/13/2002	08/13/2002	08/13/2002	02/25/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**												
BTEX	mg/kg																	
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	**0.002**	0.001 U	**0.001 J**	0.001 U	**0.005 J**	0.001 U	0.001 U	0.001 U	**130**	**0.007**	**0.003**
Ethyl benzene		100-41-4	1	41	390	780	**0.001 J**	**0.003**	**0.002**	**0.004**	0.001 U	0.001 U	0.001 U	0.001 U	**0.001 J**	**96**	**0.002**	**0.002**
Toluene		108-88-3	0.7	100	500	1000	0.001 U	**0.004**	**0.003**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**49**	**0.005**	**0.001**
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.005**	**0.012**	**0.006**	**0.007**	0.001 U	0.001 U	0.001 U	0.001 U	**0.006**	**500**	**0.01**	**0.014**
Total BTEX							**0.006**	**0.021**	**0.011**	**0.012**	0	**0.005**	0	0	**0.007**	**775**	**0.024**	**0.02**
Volatile Organic Compounds	ug/kg																	
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																	
Carcinogenic PAHs																		
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.42 U	**0.31 J**	**0.044 J**	**0.094 J**	**0.24 J**	0.41 U	**0.047 J**	0.4 U	0.42 U	**250 J**	0.38 U	**0.086 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.42 U	**0.24 J**	0.41 U	**0.074 J**	**0.16 J**	0.41 U	0.41 U	0.4 U	0.42 U	**180 J**	0.38 U	0.39 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.42 U	**0.19 J**	0.41 U	**0.06 J**	**0.12 J**	0.41 U	0.41 U	0.4 U	0.42 U	**130 J**	0.38 U	0.39 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.42 U	**0.061 J**	0.41 U	**0.029 J**	**0.052 J**	0.41 U	0.41 U	0.4 U	0.42 U	**56 J**	0.38 U	0.39 U
Chrysene		218-01-9	1	3.9	56	110	0.42 U	**0.26 J**	**0.044 J**	**0.082 J**	**0.24 J**	0.41 U	**0.049 J**	0.4 U	0.42 U	**270 J**	0.38 U	**0.075 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.42 U	0.4 U	0.41 U	0.43 U	0.39 U	0.41 U	0.41 U	0.4 U	0.42 U	290 U	0.38 U	0.39 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.42 U	**0.07 J**	0.41 U	0.43 U	0.39 U	0.41 U	0.41 U	0.4 U	0.42 U	**68 J**	0.38 U	0.39 U
Total Carcinogenic PAHs							0	**1.131**	**0.088**	**0.339**	**0.812**	0	**0.096**	0	0	**954**	0	**0.161**
Non-Carcinogenic PAHs																		
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.42 U	**0.14 J**	0.41 U	**0.071 J**	**0.21 J**	0.41 U	0.41 U	0.4 U	0.42 U	**1600**	0.38 U	**0.28 J**
Acenaphthene		83-32-9	20	100	500	1000	0.42 U	**0.44**	**0.045 J**	**0.076 J**	**0.16 J**	0.41 U	0.41 U	0.4 U	0.42 U	**91 J**	0.38 U	0.39 U
Acenaphthylene		208-96-8	100	100	500	1000	0.42 U	**0.12 J**	0.41 U	0.43 U	**0.39 J**	0.41 U	**0.058 J**	0.4 U	0.42 U	**720**	0.38 U	**0.16 J**
Anthracene		120-12-7	100	100	500	1000	0.42 U	**0.48**	**0.05 J**	**0.11 J**	**0.42**	0.41 U	**0.097 J**	0.4 U	0.42 U	**440**	0.38 U	**0.12 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.42 U	**0.089 J**	0.41 U	0.43 U	**0.045 J**	0.41 U	0.41 U	0.4 U	0.42 U	**85 J**	0.38 U	0.39 U
Fluoranthene		206-44-0	100	100	500	1000	0.42 U	**0.55**	**0.09 J**	**0.22 J**	**0.45**	0.41 U	**0.1 J**	0.4 U	0.42 U	**490**	0.38 U	**0.16 J**
Fluorene		86-73-7	30	100	500	1000	0.42 U	**0.43**	**0.045 J**	**0.11 J**	**0.43**	0.41 U	**0.078 J**	0.4 U	0.42 U	**540**	0.38 U	**0.13 J**
Naphthalene		91-20-3	12	100	500	1000	0.42 U	**0.09 J**	0.41 U	**0.067 J**	**0.41**	0.41 U	0.41 U	0.4 U	**0.16 J**	**3800**	0.38 U	**0.47**
Phenanthrene		85-01-8	100	100	500	1000	**0.06 J**	**1.6**	**0.26 J**	**0.62**	**1.5**	0.41 U	**0.28 J**	0.4 U	**0.055 J**	**1500**	0.38 U	**0.5**
Pyrene		129-00-0	100	100	500	1000	0.42 U	**1**	**0.13 J**	**0.31 J**	**0.81**	0.41 U	**0.14 J**	0.4 U	**0.042 J**	**810**	0.38 U	**0.27 J**
Total Non-Carcinogenic PAHs							**0.06**	**4.936**	**0.62**	**1.584**	**4.825**	0	**0.753**	0	**0.257**	**10076**	0	**2.09**
Total PAHs							**0.06**	6.067	**0.708**	**1.923**	**5.637**	0	**0.849**	0	**0.257**	**11030**	0	**2.251**
Other Semivolatile Organic Compounds	ug/lg																	
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	420 U	400 U	410 U	430 U	390 U	410 U	410 U	400 U	420 U	**59000 J**	380 U	390 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE												
Metals	mg/kg																	
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.46 B**	0.34 U	**0.91**	**0.96 B**	NA	NA	NA	NA	NA	NA	NA	NA
Barium		7440-39-3	350	400	400	10000	**2 B**	**3.7 B**	**2.8 B**	**2.7 B**	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.18 U	0.23 U	0.17 U	0.2 U	NA	NA	NA	NA	NA	NA	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**2.6**	**3.4**	**3.6**	**2.4**	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**0.63 B**	**1.8**	**0.73 B**	**0.94 B**	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.017 U	0.018 U	0.019 U	0.018 U	NA	NA	NA	NA	NA	NA	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.37 U	0.45 U	0.34 U	0.39 U	NA	NA	NA	NA	NA	NA	NA	NA
Silver		7440-22-4	2	180	1500	6800	0.3 B	0.34 U	0.26 U	0.29 U	NA	NA	NA	NA	NA	NA	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																	
Cyanide, total		57-12-5	27	27	27	10,000	**1.1**	**0.064 B**	0.041 U	0.046 U	0.26 U	0.29 U	0.30 U	0.26 U	**0.43 B**	0.24 U	0.29 U	**0.13 B**

Table 3A. Post Remediation Soil Impacts – On-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	**RPSB-31A**	**RPSB-42**	**RPSB-43**	**RPSB-44**	**RPSB-92A**	**RPSB-92A**
							Sample Name	**SB-31A (133-135)**	**RPSB-42 (124-126)**	**RPSB-43 (95-97)**	**RPSB-44 (149-151)**	**PSB-92A (98-100)**	**RPSB-92A (98-100)**
							Start Depth	**133**	**124**	**95**	**149**	**98**	**98**
							End Depth	**135**	**126**	**97**	**151**	**100**	**100**
							Depth Unit	**ft**	**ft**	**ft**	**ft**	**ft**	**ft**
							Sample Date	**03/10/2000**	**02/29/2000**	**12/03/1999**	**03/15/2000**	**11/08/2001**	**11/08/2001**
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**							
BTEX	mg/kg												
Benzene		71-43-2	0.06	4.8	44	89	**0.003**	0.001 U	0.001 U	**0.001**	**0.43**	NA
Ethyl benzene		100-41-4	1	41	390	780	**0.002**	0.001 U	0.001 U	**0.002**	**8**	NA
Toluene		108-88-3	0.7	100	500	1000	0.001 U	**0.003**	**0.001**	**0.001**	**1.6**	NA
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.014**	**0.013**	**0.003**	**0.014**	**17**	NA
Total BTEX							**0.019**	**0.016**	**0.004**	**0.018**	**27.03**	0
Volatile Organic Compounds	ug/kg											
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg											
Carcinogenic PAHs												
Benzo(a)anthracene		56-55-3	1	1	5.6	11	**0.15 J**	**0.1 J**	**0.05 J**	**0.061 J**	NA	**20**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**0.12 J**	**0.072 J**	0.41 U	**0.048 J**	NA	**19**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**0.088 J**	**0.056 J**	0.41 U	0.41 U	NA	**14**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.39 U	0.39 U	0.41 U	0.41 U	NA	**6.4**
Chrysene		218-01-9	1	3.9	56	110	**0.15 J**	**0.088 J**	**0.044 J**	**0.061 J**	NA	**19**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.39 U	0.39 U	0.41 U	0.41 U	NA	**2 J**
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.39 U	0.39 U	0.41 U	0.41 U	NA	**5.4**
Total Carcinogenic PAHs							**0.508**	**0.316**	**0.094**	**0.17**	NA	**85.8**
Non-Carcinogenic PAHs												
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	**0.63**	**0.077 J**	**0.061 J**	**0.13 J**	NA	**210 D**
Acenaphthene		83-32-9	20	100	500	1000	**0.1 J**	0.39 U	0.41 U	0.41 U	NA	**8.4**
Acenaphthylene		208-96-8	100	100	500	1000	**0.27 J**	**0.1 J**	**0.071 J**	**0.1 J**	NA	**130 D**
Anthracene		120-12-7	100	100	500	1000	**0.23 J**	**0.14 J**	**0.075 J**	**0.086 J**	NA	**38**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.39 U	0.39 U	0.41 U	0.41 U	NA	**5.3**
Fluoranthene		206-44-0	100	100	500	1000	**0.28 J**	**0.22 J**	**0.12 J**	**0.12 J**	NA	**35**
Fluorene		86-73-7	30	100	500	1000	**0.29 J**	**0.1 J**	**0.068 J**	**0.096 J**	NA	**56**
Naphthalene		91-20-3	12	100	500	1000	**0.98**	**0.15 J**	**0.14 J**	**0.28 J**	NA	**400 D**
Phenanthrene		85-01-8	100	100	500	1000	**0.96**	**0.52**	**0.3 J**	**0.35 J**	NA	**200 D**
Pyrene		129-00-0	100	100	500	1000	**0.47**	**0.27 J**	**0.15 J**	**0.18 J**	NA	**51**
Total Non-Carcinogenic PAHs							**4.21**	**1.577**	**0.985**	**1.342**	NA	**1133.7**
Total PAHs							**4.718**	**1.893**	**1.079**	**1.512**	NA	**1219.5**
Other Semivolatile Organic Compounds	ug/lg											
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	390 U	390 U	410 U	410 U	NA	**5500**
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE						
Metals	mg/kg											
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**1.4**	**4**	**1.3**	**0.91**	NA	NA
Barium		7440-39-3	350	400	400	10000	**6.5 B**	**52.9**	**30.3 E**	**10.1 B**	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	**0.11 B**	0.045 U	**1.6**	**0.12 B**	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**2.7**	**12.7**	**11.7**	**2.2**	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**2.2**	**8.8**	**5.1**	**1.7**	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.016 U	0.019 U	0.02 U	0.021 U	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.31 U	0.45 U	**5.9**	0.32 U	NA	NA
Silver		7440-22-4	2	180	1500	6800	**0.27 B**	0.23 U	**1.2 B**	**0.32 B**	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg											
Cyanide, total		57-12-5	27	27	27	10,000	0.22 U	0.11 U	**0.071 B**	0.15 U	NA	7 U

Table 3B. Post Remediation Soil Impacts – Off-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Analyte	Units	CAS No.	Unrestricted SCO	Restricted Residential SCO	Commercial SCO	Industrial SCO	Location Name	RPSB-01	RPSB-03	RPSB-05	RPSB-109	RPSB-110	RPSB-111	RPSB-112	RPSB-114	RPSB-115	RPSB-70	RPSB-70	RPSB-70	RPSB-83	RPSB-83	RPSB-84	RPSB-86	RPSB-87	RPMW-02D2	RPMW-02D2
							Sample Name	RPSB-01 (5-7)	RPSB-03 (5-7)	RPSB-05 (4-6)	RPSB-109 (4-6)	RPSB-110 (4-6)	RPSB-111 (4-6)	RPSB-112 (4-6)	RPSB-114 (4-6)	RPSB-115 (8-10)	RPSB-70 (4-6)	RPSB-70 (6-8)	RPSB-70 (8-10)	RPSB-83 (4-6)	RPSB-83 (9-11)	RPSB-84 (4-5)	RPSB-86 (4-6)	RPSB-87 (4-6)	RPMW-02D2 (19-23)	RPSBXX082902-1
							Start Depth	5	5	4	4	4	4	4	4	8	4	6	8	4	9	4	4	4	19	19
							End Depth	7	7	6	6	6	6	6	6	10	6	8	10	6	11	5	6	6	23	23 (Dup)
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	02/07/2000	02/10/2000	02/16/2000	11/05/2001	11/05/2001	11/05/2001	11/05/2001	03/22/2002	03/22/2002	03/03/2000	03/03/2000	03/03/2000	03/05/2002	03/05/2002	03/06/2002	03/07/2002	03/08/2002	08/29/2002	08/29/2002
BTEX	mg/kg																									
Benzene		71-43-2	0.06	4.8	44	89		0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.003 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.037**	**0.058**
Ethyl benzene		100-41-4	1	41	390	780		0.005 U	**0.001**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.001**	0.001 U	**0.23**	0.001 U	**0.005**	**0.003**	0.001 U	**0.057**	**0.075**
Toluene		108-88-3	0.7	100	500	1000		0.005 U	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	**0.042**	**0.002**	**0.006**	**0.002**	0.001 U	**0.002**	0.002 U
Xylene (total)		1330-20-7	0.26	100	500	1000		0.005 U	**0.007**	0.001 U	**0.005**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001	0.001 U	**0.26**	**0.002**	**0.008**	**0.012**	**0.002**	**0.021**	**0.021**
Total BTEX								0	**0.01**	0	**0.005**	0	0	0	0	0	**0.004**	0.002	0	**0.532**	**0.004**	**0.019**	**0.017**	**0.002**	**0.117**	**0.154**
VOCs	ug/kg																									
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		**4 JB**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000			5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (SVOCs)	mg/kg																									
Carcinogenic PAHs																										
Benzo(a)anthracene		56-55-3	1	1	5.6	11		0.34 U	**0.54 J**	0.35 U	0.39 U	0.39 U	**0.043 J**	0.35 U	**59**	0.41 U	**1.6 J**	3.9 U	4 U	**1.5 J**	**0.044 J**	**0.14 J**	**0.21 J**	0.42 U	**0.8**	**2.3 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1		0.34 U	**0.38 J**	0.35 U	0.39 U	0.39 U	**0.044 J**	0.35 U	**27**	0.41 U	**1.5 J**	3.9 U	4 U	8.2 U	0.42 U	**0.52**	**0.18 J**	0.42 U	**0.4 J**	**1.4 J**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.34 U	**0.49 J**	0.35 U	0.39 U	0.39 U	**0.05 J**	0.35 U	**34**	0.41 U	**2.5 J**	3.9 U	4 U	8.2 U	0.42 U	**0.59**	**0.23 J**	0.42 U	**0.32 J**	**0.51 J**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**18**	0.41 U	**0.71 J**	3.9 U	4 U	8.2 U	0.42 U	**0.19 J**	**0.064 J**	0.42 U	**0.14 J**	**0.96 J**
Chrysene		218-01-9	1	3.9	56	110		0.34 U	**0.61 J**	0.35 U	0.39 U	0.39 U	**0.051 J**	0.35 U	**65**	0.41 U	**1.7 J**	3.9 U	4 U	**1.5 J**	0.42 U	**0.21 J**	**0.25 J**	0.42 U	**0.69**	**2.1 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**1.3 J**	0.41 U	4.5 U	3.9 U	4 U	8.2 U	0.42 U	**0.2 J**	0.38 U	0.42 U	0.42 U	1.6 UJ
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**12**	0.41 U	**1.2 J**	3.9 U	4 U	8.2 U	0.42 U	**0.88**	**0.13 J**	0.42 U	**0.088 J**	**0.31 J**
Total Carcinogenic PAHs								0	**2.02**	0	0	0	**0.188**	0	**216.3**	0	**9.21**	0	0	**3**	**0.044**	**2.73**	**1.064**	0	**2.438**	**7.58**
Non-Carcinogenic PAHs																										
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**21**	0.41 U	4.5 U	3.9 U	4 U	8.2 U	0.42 U	**0.074 J**	0.38 U	0.42 U	**0.073 J**	1.6 UJ
Acenaphthene		83-32-9	20	100	500	1000		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**4.3**	0.41 U	4.5 U	3.9 U	4 U	8.2 U	0.42 U	0.37 U	**0.061 J**	0.42 U	**3.5**	**15 J**
Acenaphthylene		208-96-8	100	100	500	1000		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**20**	0.41 U	4.5 U	3.9 U	4 U	**0.97 J**	0.42 U	**0.28 J**	**0.34 J**	0.42 U	**0.3 J**	**1.4 J**
Anthracene		120-12-7	100	100	500	1000		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**170 D**	0.41 U	4.5 U	3.9 U	4 U	8.2 U	0.42 U	**0.16 J**	**0.093 J**	0.42 U	**1.8**	**6.8 J**
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**12**	0.41 U	**1.3 J**	3.9 U	4 U	8.2 U	0.42 U	**1**	**0.14 J**	0.42 U	0.42 U	**0.34 J**
Fluoranthene		206-44-0	100	100	500	1000		0.34 U	**0.45 J**	0.35 U	0.39 U	0.39 U	**0.083 J**	0.35 U	**150 D**	**0.044 J**	**2.8 J**	3.9 U	4 U	**2.9 J**	**0.1 J**	**0.097 J**	**0.21 J**	0.42 U	**2.1**	**5.3 J**
Fluorene		86-73-7	30	100	500	1000		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**68**	0.41 U	4.5 U	3.9 U	4 U	8.2 U	0.42 U	0.37 U	0.38 U	0.42 U	**1.6**	**6 J**
Naphthalene		91-20-3	12	100	500	1000		0.34 U	3.5 U	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**6.6**	0.41 U	4.5 U	3.9 U	4 U	8.2 U	0.42 U	**0.13 J**	**0.056 J**	0.42 U	**0.34 J**	**0.79 J**
Phenanthrene		85-01-8	100	100	500	1000		**0.042 J**	**0.66 J**	0.35 U	0.39 U	0.39 U	0.36 U	0.35 U	**350 D**	0.41 U	**1.5 J**	3.9 U	4 U	8.2 U	0.42 U	**0.11 J**	**0.13 J**	0.42 U	**4.9**	**20 J**
Pyrene		129-00-0	100	100	500	1000		0.34 U	**0.96 J**	0.35 U	0.39 U	0.39 U	**0.11 J**	0.35 U	**240 D**	**0.069 J**	**2.6 J**	3.9 U	4 U	**4.1**	**0.23 J**	**0.18 J**	**0.39**	0.42 U	**3.6**	**9.4 J**
Total Non-Carcinogenic PAHs								**0.042**	**2.07**	0	0	0	**0.193**	0	**1041.9**	**0.113**	**8.2**	0	0	**7.97**	**0.33**	**2.031**	**1.42**	0	**18.213**	**65.03**
Total PAHs								**0.042**	**4.09**	0	0	0	**0.381**	0	**1258.2**	**0.113**	**17.41**	0	0	10.97	**0.374**	**4.761**	**2.484**	0	**20.651**	**72.61**
Other Semivolatile Organic Compounds	ug/kg																									
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		340 U	3500 U	350 U	390 U	390 U	360 U	350 U	**5300**	410 U	4500 U	3900 U	4000 U	8200 U	420 U	370 U	380 U	420 U	**140 J**	**470 J**
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		340 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																									
Aluminum		7429-90-5	NE	NE	NE	NE		**313**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		0.15 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		**0.5 B**	**2.7**	**1 B**	NA	NA	NA	NA	**19.6**	**1.1**	NA	NA	NA	**1.6**	**2.0**	**8**	**4.4**	**1.4**	NA	NA
Barium		7440-39-3	350	400	400	10000		**2.5 B**	**72.4**	**3 B**	NA	NA	NA	NA	**41.2**	**3.3 B**	NA	NA	NA	**2.0 B**	**3.3 B**	**12.8**	**5.0 B**	**3.8 B**	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700		0.15 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		0.15 U	**0.99**	**0.16 B**	NA	NA	NA	NA	0.12 U	0.11 U	NA	NA	NA	0.12 U	0.12 U	**0.24 B**	**0.13 B**	0.12 U	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE		**36000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		**0.37 B**	**11.2**	**1.7**	NA	NA	NA	NA	**6.1**	**2.2**	NA	NA	NA	**1.6**	**6.9**	**9.7**	**2.8**	**2.9**	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE		**0.35 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		**1.1 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		**666**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		**0.37 B**	**162**	**24.3**	NA	NA	NA	NA	**206**	**7.9**	NA	NA	NA	**2.2**	**1.5**	**25.4**	**6.5**	**1.6**	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE		**231**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		**22.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		0.013 U	**0.068**	0.017 U	NA	NA	NA	NA	**0.14**	0.019 U	NA	NA	NA	**0.022 B**	**0.034 B**	**0.055**	**0.12**	**0.021 B**	NA	NA
Nickel		7440-02-0	30	310	310	10000		**0.6 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		**103 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		0.3 U	0.39 U	0.24 U	NA	NA	NA	NA	0.48 U	0.43 U	NA	NA	NA	0.46 U	0.47 U	0.42 U	0.43 U	0.46 U	NA	NA
Silver		7440-22-4	2	180	1500	6800		0.23 U	**1.3 B**	**0.28 B**	NA	NA	NA	NA	0.12 U	0.11 U	NA	NA	NA	0.12 U	0.12 U	0.10 U	0.11 U	**0.13 B**	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE		**483**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		0.23 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		**1.3 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		**3.2 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																									
Cyanide, total		57-12-5	27	27	27	10,000		**0.085 B**	**2.6**	**0.092 B**	7 U	7 U	**1**	7 U	**4.5**	**0.70 B**	**9.3**	0.21 U	**0.28 B**	**1.1 B**	**1.2**	**0.48 B**	0.27 U	0.29 U	0.28 U	0.29 U

Table 3B. Post Remediation Soil Impacts – Off-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-02	RPSB-130	RPSB-86	RPSB-87	RPSB-01	RPSB-02	RPSB-02A	RPSB-03	RPSB-04	RPSB-05	RPSB-116	RPSB-83	RPSB-84	RPSB-84	RPSB-85	RPSB-85	RPSB-86	RPSB-87
							Sample Name	RPSB-02 (20-22)	RPSB-130 (22-24)	RPSB-86 (21-22)	RPSB-87 (21-23)	RPSB-01 (38-40)	RPSB-02 (40-42)	RPSB-02A (30-32)	RPSB-03 (30-32)	RPSB-04 (25-27)	RPSB-05 (24-26)	RBSB-116 (44-46)	RPSB-83 (40-41)	RPSB-84 (24-26)	RPSB-84 (36-37)	RPSB-85 (24-25)	RPSB-85 (36-38)	RPSB-86 (40-41)	RPSB-87 (37-39)
							Start Depth	20	22	21	21	38	40	30	30	25	24	44	40	24	36	24	36	40	37
							End Depth	22	24	22	23	40	42	32	32	27	26	46	41	26	37	25	38	41	39
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	02/09/2000	08/28/2002	03/07/2002	03/08/2002	02/07/2000	02/09/2000	02/18/2000	02/10/2000	02/14/2000	02/16/2000	04/01/2002	03/05/2002	03/06/2002	03/06/2002	03/06/2002	03/06/2002	03/07/2002	03/08/2002
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																			
BTEX	mg/kg																								
Benzene		71-43-2	0.06	4.8	44	89		0.001 U	**0.45**	**0.025**	**0.004**	0.001 U	0.001 U	**0.002**	**0.15**	0.001 U	**0.002**	0.001 U	0.001 U	0.6 U	**0.002**	0.57 U	**0.002**	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780		0.001 U	**0.052**	**0.019**	0.002 U	0.001 U	**0.002**	**0.035**	**0.63**	**0.001**	**0.005**	**0.008**	**0.002**	**37**	**0.002**	**51 D**	**0.001 J**	0.001 U	0.001 U
Toluene		108-88-3	0.7	100	500	1000		0.001 U	0.018 U	**0.002**	0.002 U	**0.002**	**0.001**	0.001 U	0.012 U	0.001 U	0.001 U	0.001 U	**0.002**	0.6 U	0.001 U	0.57 U	0.001 U	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000		**0.002**	**0.045**	**0.008**	**0.006**	**0.003**	**0.003**	**0.021**	**0.21**	**0.001**	**0.006**	**0.011**	**0.001 J**	**27**	**0.003**	**28**	**0.002**	**0.003**	0.001 U
Total BTEX								**0.002**	**0.547**	**0.054**	**0.01**	**0.005**	**0.006**	**0.058**	**0.99**	**0.002**	**0.013**	**0.019**	**0.005**	**64**	**0.007**	**79**	**0.005**	**0.003**	0
VOCs	ug/kg																								
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (SVOCs)	mg/kg																								
Carcinogenic PAHs																									
Benzo(a)anthracene		56-55-3	1	1	5.6	11		0.4 U	**0.44 J**	4.2 U	**0.57**	0.42 U	0.4 U	**8.5**	**28**	0.4 U	0.39 U	**0.35**	0.39 U	**25**	**0.17 J**	**50**	0.4 U	0.41 U	0.4 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1		0.4 U	**0.49 J**	4.2 U	**0.44 J**	0.42 U	0.4 U	**7**	**21**	0.4 U	0.39 U	**0.3 J**	0.39 U	**15 DJ**	**0.09 J**	**33**	0.4 U	0.41 U	0.4 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.4 U	**0.56 J**	4.2 U	**0.51 J**	0.42 U	0.4 U	**6**	**16**	0.4 U	0.39 U	**0.27 J**	0.39 U	**12**	**0.07 J**	**24**	0.4 U	0.41 U	0.4 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.4 U	**0.21 J**	4.2 U	**0.18 J**	0.42 U	0.4 U	**2.2**	**8.2 J**	0.4 U	0.39 U	**0.1 J**	0.39 U	**4.4**	**0.09 J**	**10**	0.4 U	0.41 U	0.4 U
Chrysene		218-01-9	1	3.9	56	110		0.4 U	**0.52 J**	4.2 U	**0.61**	0.42 U	0.4 U	**8**	**23**	0.4 U	0.39 U	**0.34**	0.39 U	**24**	**0.15 J**	**47**	0.4 U	0.41 U	0.4 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.4 U	0.62 U	4.2 U	0.56 U	0.42 U	0.4 U	**0.97 J**	8.4 U	0.4 U	0.39 U	**0.038 J**	0.39 U	**1.5 J**	0.4 U	**3.5 J**	0.4 U	0.41 U	0.4 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.4 U	**0.26 J**	4.2 U	**0.27 J**	0.42 U	0.4 U	**3.2**	**7.7 J**	0.4 U	0.39 U	**0.15 J**	0.39 U	**4.6**	0.4 U	**10**	0.4 U	0.41 U	0.4 U
Total Carcinogenic PAHs								0	**2.48**	0	**2.58**	0	0	**35.87**	**103.9**	0	0	**1.548**	0	**86.5**	**0.57**	**177.5**	0	0	0
Non-Carcinogenic PAHs																									
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		0.4 U	**0.22 J**	4.2 U	**0.068 J**	**0.092 J**	0.4 U	**1.7**	**58**	0.4 U	0.39 U	**0.97**	0.39 U	**200 D**	**0.38 J**	**290 D**	0.4 U	0.41 U	0.4 U
Acenaphthene		83-32-9	20	100	500	1000		0.4 U	**0.31 J**	4.2 U	**0.073 J**	**0.074 J**	0.4 U	**23**	**65**	0.4 U	0.39 U	**2.2**	**0.055 J**	**200 D**	**0.94**	**160 D**	0.4 U	0.41 U	0.4 U
Acenaphthylene		208-96-8	100	100	500	1000		0.4 U	0.62 U	4.2 U	**0.11 J**	**0.058 J**	0.4 U	**19**	**4 J**	0.4 U	0.39 U	**0.44**	0.39 U	**14**	**0.15 J**	**93 D**	0.4 U	0.41 U	0.4 U
Anthracene		120-12-7	100	100	500	1000		0.4 U	**0.22 J**	**0.64 J**	**0.22 J**	0.42 U	0.4 U	**3.7**	**35**	0.4 U	0.39 U	**0.69**	0.39 U	**61**	**0.57**	**110 D**	**0.063 J**	0.41 U	0.4 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.4 U	**0.29 J**	4.2 U	**0.27 J**	0.42 U	0.4 U	**3.4**	**8.2 J**	0.4 U	0.39 U	**0.18 J**	0.39 U	**4.5**	0.4 U	**10**	0.4 U	0.41 U	0.4 U
Fluoranthene		206-44-0	100	100	500	1000		0.4 U	**0.96**	**0.82 J**	**0.98**	0.42 U	0.4 U	**16**	**47**	0.4 U	0.39 U	**0.74**	**0.1 J**	**49**	**0.37 J**	**100 D**	**0.053 J**	0.41 U	0.4 U
Fluorene		86-73-7	30	100	500	1000		0.4 U	**0.1 J**	4.2 U	**0.098 J**	0.42 U	0.4 U	1.5 U	**37**	0.4 U	0.39 U	**0.72**	0.39 U	**87 D**	**0.49**	**140 D**	0.4 U	0.41 U	0.4 U
Naphthalene		91-20-3	12	100	500	1000		0.4 U	**3.5**	**0.71 J**	**0.2 J**	0.42 U	0.4 U	**12**	**91**	0.4 U	0.39 U	**1.7**	**0.046 J**	**520 D**	**1**	**480 D**	0.4 U	0.41 U	0.4 U
Phenanthrene		85-01-8	100	100	500	1000		0.4 U	**0.43 J**	**0.76 J**	**0.34 J**	**0.047 J**	0.4 U	**2.2**	**110**	**0.073 J**	**0.059 J**	**2**	**0.18 J**	**250 D**	**1.6**	**410 D**	**0.11 J**	0.41 U	0.4 U
Pyrene		129-00-0	100	100	500	1000		0.4 U	**0.92**	**0.94 J**	**0.97**	0.42 U	0.4 U	**26 D**	**72**	0.4 U	0.39 U	**1**	**0.08 J**	**83 D**	0.4 U	**160 D**	**0.084 J**	0.41 U	0.4 U
Total Non-Carcinogenic PAHs								0	**6.95**	**3.87**	**3.329**	**0.271**	0	**107**	**527.2**	**0.073**	**0.059**	**10.64**	**0.461**	**1468.5**	**5.5**	**1953**	**0.31**	0	0
Total PAHs								0	**9.43**	**3.87**	**5.909**	**0.271**	0	**142.87**	**631.1**	**0.073**	**0.059**	**12.188**	**0.461**	**1555**	**6.07**	**2130.5**	**0.31**	0	0
Other Semivolatile Organic Compounds	ug/kg																								
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		400 U	620 U	4200 U	560 U	420 U	400 U	**560 J**	**3500 J**	400 U	390 U	**79 J**	390 U	**7200**	**43 J**	**10000**	400 U	410 U	400 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																								
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		**0.4 B**	NA	**10.6**	**13.4**	**1.4 B**	**0.79 B**	**12.9**	**2.2**	**0.65 B**	**0.61 B**	**0.86 B**	**0.75 B**	**0.88 B**	**0.72 B**	**0.69 B**	**0.65 B**	**0.76 B**	**1.2**
Barium		7440-39-3	350	400	400	10000		**0.72 B**	NA	**40.0**	**51.4**	**2.1 B**	**1.8 B**	**9.7 B**	**11.3 B**	**2.7 B**	**2.7 B**	**3.3 B**	**1.1 B**	**2.9 B**	**1.7 B**	**2.2 B**	**1.2 B**	**2.4 B**	**2.2 B**
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		0.04 U	NA	**0.80**	**0.95**	0.21 U	**0.078 B**	**1**	**1.2**	0.034 U	0.033 U	0.11 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	0.11 U	0.12 U
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		**0.92 B**	NA	**23.2**	**29.9**	**1.9 B**	**1.9**	**5.1**	**8.5**	**2.5**	**3.2**	**3.4**	**3.0**	**1.8**	**2.0**	**1.7**	**1.3**	**4.8**	**1.8**
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		**0.37 B**	NA	**74.7**	**97.6**	0.31 U	**0.58 B**	**90.5**	**40.2**	**1.2**	**2.6**	**9.3**	**0.44 B**	**14.3**	**0.53 B**	**0.69**	**0.43 B**	**1.6**	**0.55 B**
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		0.018 U	NA	**1.0**	**1.6**	0.018 U	0.019 U	**0.26**	**0.44**	0.02 U	0.019 U	0.019 U	0.020 U	**0.086**	0.020 U	0.017 U	0.020 U	0.02 U	0.019 U
Nickel		7440-02-0	30	310	310	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		0.4 U	NA	**0.50 B**	0.61 U	0.42 U	0.33 U	**3.4**	**7.1**	0.34 U	**0.4 B**	0.43 U	0.43 U	0.46 U	0.43 U	0.45 U	0.42 U	0.44 U	0.47 U
Silver		7440-22-4	2	180	1500	6800		0.2 U	NA	0.12 U	0.15 U	0.31 U	0.17 U	**2.2 B**	**0.6 B**	0.17 U	0.16 U	0.11 U	0.11 U	0.12 U	0.11 U	0.11 U	0.11 U	**0.13 B**	0.12 U
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																								
Cyanide, total		57-12-5	27	27	27	10,000		0.1 U	0.42 U	0.31 U	0.40 U	**0.057 B**	**0.12 B**	**4.6**	**0.21 B**	0.11 U	0.1 U	**0.38 B**	0.35 U	0.31 U	0.28 U	0.28 U	0.29 U	0.29 U	0.28 U

Table 3B. Post Remediation Soil Impacts – Off-Site Property
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Location Name							RPSB-87A	RPMW-02D2	RPSB-02A	RPSB-04	RPSB-05	RPSB-116	RPSB-116	RPSB-130	RPSB-87A	RPMW-02D2	RPSB-130
Sample Name							RPSB-87A (38-40)	RPMW-02D2 (62-66)	RPSB-02A (55-57)	RPSB-04 (45-47)	RPSB-05 (65-67)	RPSB-116 (54-56)	RPSB-116 (66-68)	RPSB-130 (47-57)	RPSB-87A (58-60)	RPMW-02D2 (97-107)	RPSB-130 (87-97)
Start Depth							38	62	55	45	65	54	66	47	58	97	87
End Depth							40	66	57	47	67	56	68	57	60	107	97
Depth Unit							ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
Sample Date							03/28/2002	08/29/2002	02/18/2000	02/15/2000	02/17/2000	04/01/2002	04/01/2002	08/28/2002	03/28/2002	08/29/2002	08/28/2002
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**											
BTEX	mg/kg																
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	0.11 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	0.001 U	**11**	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U
Toluene		108-88-3	0.7	100	500	1000	0.001 U	0.11 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	0.001 U	**2.8**	**0.002**	**0.001**	**0.003**	**0.003**	0.001 U	0.001 U	0.001 U	**0.003**	0.001 U
Total BTEX							0	**13.8**	**0.002**	**0.001**	**0.003**	**0.005**	0	0	0	**0.005**	0
VOCs	ug/kg																
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds (SVOCs)	mg/kg																
Carcinogenic PAHs																	
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.4 U	**70**	0.4 U	0.39 U	0.38 U	**0.23 J**	**0.16 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.4 U	**55**	0.4 U	0.39 U	0.38 U	**0.19 J**	**0.14 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.4 U	**41**	0.4 U	0.39 U	0.38 U	**0.16 J**	**0.13 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.4 U	**19 J**	0.4 U	0.39 U	0.38 U	**0.075 J**	**0.044 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Chrysene		218-01-9	1	3.9	56	110	0.4 U	**64**	0.4 U	0.39 U	0.38 U	**0.23 J**	**0.16 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.4 U	32 U	0.4 U	0.39 U	0.38 U	0.33 U	0.33 U	0.4 U	0.42 U	0.41 U	0.42 UJ
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.4 U	**14 J**	0.4 U	0.39 U	0.38 U	**0.1 J**	**0.077 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Total Carcinogenic PAHs							0	**263**	0	0	0	**0.985**	**0.711**	0	0	0	0
Non-Carcinogenic PAHs																	
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.4 U	**80**	0.4 U	0.39 U	0.38 U	**0.66**	**0.24 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Acenaphthene		83-32-9	20	100	500	1000	0.4 U	**36**	0.4 U	0.39 U	0.38 U	**1.7**	**0.74**	0.4 U	0.42 U	0.41 U	0.42 UJ
Acenaphthylene		208-96-8	100	100	500	1000	0.4 U	**280**	0.4 U	0.39 U	0.38 U	**0.3 J**	**0.2 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Anthracene		120-12-7	100	100	500	1000	0.4 U	**130**	0.4 U	0.39 U	0.38 U	**0.51**	**0.27 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.4 U	**14 J**	0.4 U	0.39 U	0.38 U	**0.12 J**	**0.093 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Fluoranthene		206-44-0	100	100	500	1000	0.4 U	**140**	0.4 U	0.39 U	0.38 U	**0.52**	**0.35**	0.4 U	0.42 U	0.41 U	0.42 UJ
Fluorene		86-73-7	30	100	500	1000	0.4 U	**180**	0.4 U	0.39 U	0.38 U	**0.51**	**0.25 J**	0.4 U	0.42 U	0.41 U	0.42 UJ
Naphthalene		91-20-3	12	100	500	1000	0.4 U	**260**	**0.057 J**	0.39 U	0.38 U	**1.5**	**0.44**	0.4 U	0.42 U	0.41 U	0.42 UJ
Phenanthrene		85-01-8	100	100	500	1000	0.4 U	**500**	0.4 U	0.39 U	0.38 U	**1.6**	**0.82**	0.4 U	0.42 U	**0.1 J**	0.42 UJ
Pyrene		129-00-0	100	100	500	1000	0.4 U	**220**	**0.048 J**	0.39 U	0.38 U	**0.72**	**0.49**	0.4 U	0.42 U	**0.054 J**	0.42 UJ
Total Non-Carcinogenic PAHs							0	**1840**	**0.105**	0	0	**8.14**	**3.893**	0	0	**0.154**	0
Total PAHs							0	**2103**	**0.105**	0	0	**9.125**	**4.604**	0	0	**0.154**	0
Other Semivolatile Organic Compounds	ug/kg																
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	400 U	**14000 J**	400 U	390 U	380 U	**57 J**	330 U	400 U	420 U	410 U	420 UJ
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**1.6**	NA	**0.47 B**	**0.59 B**	**0.53 B**	**0.75 B**	**0.71 B**	NA	**0.90 B**	NA	NA
Barium		7440-39-3	350	400	400	10000	**2.0 B**	NA	**2.1 B**	**2.2 B**	**8.5 B**	**2.7 B**	**2.5 B**	NA	**7.9 B**	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.10 U	NA	**0.053 B**	0.039 U	0.045 U	0.12 U	0.12 U	NA	0.12 U	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**1.6**	NA	**2.7**	**2.9**	**5.2**	**4.2**	**2.6**	NA	**6.0**	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**0.72**	NA	**0.85 B**	**0.68 B**	**1.8**	**19.3**	**15.8**	NA	**2.0**	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.018 U	NA	0.017 U	0.019 U	0.019 U	0.021 U	0.021 U	NA	0.020 U	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.41 U	NA	0.45 U	**0.59 B**	**0.62 B**	0.48 U	0.49 U	NA	0.50 U	NA	NA
Silver		7440-22-4	2	180	1500	6800	0.10 U	NA	0.22 U	0.2 U	0.23 U	0.12 U	0.12 U	NA	0.12 U	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																
Cyanide, total		57-12-5	27	27	27	10,000	0.38 U	0.3 U	0.11 U	0.095 U	0.12 U	**0.52 B**	0.28 U	0.30 U	**0.51 B**	0.27 U	0.31 U

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPGP-28A	RPSB-103	RPSB-104	RPSB-106	RPSB-107	RPSB-55	RPSB-56	RPSB-73	RPSB-73	RPSB-74	RPSB-74	RPSB-74	RPSB-75	RPSB-75	RPSB-75	RPSB-76	RPSB-76	RPSB-76	RPGP-28A
							Sample Name	RPGP-28A (4-8)	RPSB-103 (4-6)	RPSB-104 (4-6)	RPSB-106 (6-8)	RPSB-107 (4-6)	RPSB-55 (10-12)	RPSB-56 (5-7)	RPSB-73 (4-6)	RPSB-73 (8-10)	RPSB-74 (4-6)	RPSB-74 (8-10)	RPSB-74 (10-12)	RPSB-75 (4-6)	RPSB-75 (6-8)	RPSB-75 (8-10)	RPSB-76 (4-6)	RPSB-76 (6-8)	RPSB-76 (8-10)	RPGP-28A (20-24)
							Start Depth	4	4	4	6	4	10	5	4	8	4	8	10	4	6	8	4	6	8	20
							End Depth	8	6	6	8	6	12	7	6	10	6	10	12	6	8	10	6	8	10	24
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	07/24/2002	11/07/2001	11/07/2001	11/07/2001	11/07/2001	03/06/2000	03/06/2000	02/25/2000	02/25/2000	02/25/2000	02/25/2000	02/25/2000	02/28/2000	02/28/2000	02/28/2000	02/28/2000	02/28/2000	02/28/2000	07/24/2002
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																				
BTEX	mg/kg																									
Benzene		71-43-2	0.06	4.8	44	89		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U
Ethyl benzene		100-41-4	1	41	390	780		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U
Toluene		108-88-3	0.7	100	500	1000		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U
Xylene (total)		1330-20-7	0.26	100	500	1000		**0.007**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.013 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.005 U
Total BTEX								**0.007**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Volatile Organic Compounds	ug/kg																									
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	NA	NA	NA	NA	NA	13 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	5 U
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1 J**
Acetone		67-64-1	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	**16 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**11**
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2 J**
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	NA	NA	NA	NA	NA	13 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	5 U
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	**15**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7 B**
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	NA	NA	NA	NA	NA	13 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	5 U
Trichloroethene		79-01-6	470	21000	200000	400000		NA	NA	NA	NA	NA	NA	13 U	NA	5 U	NA	5 U	NA	NA	NA	NA	NA	NA	NA	5 U
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																									
Carcinogenic PAHs																										
Benzo(a)anthracene		56-55-3	1	1	5.6	11		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**26**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	**0.046 J**	**10**	0.39 U	0.38 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1		0.42 UJ	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**25**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**6.9**	0.39 U	0.38 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.42 UJ	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**32**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**8.7**	0.39 U	0.38 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.42 UJ	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**8.4**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**3.8**	0.39 U	0.38 U
Chrysene		218-01-9	1	3.9	56	110		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**25**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	**0.047 J**	**7.9**	0.39 U	0.38 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.42 UJ	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**3.8 J**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**1 J**	0.39 U	0.38 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.42 UJ	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**17**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**3.4**	0.39 U	0.38 U
Total Carcinogenic PAHs								0	0	0	0	0	0	**137.2**	0	0	0	0	0	0	0	0	**0.093**	**41.7**	0	0
Non-Carcinogenic PAHs																										
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**5.5 J**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	1.7 U	0.39 U	0.38 U
Acenaphthene		83-32-9	20	100	500	1000		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**14**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	1.7 U	0.39 U	0.38 U
Acenaphthylene		208-96-8	100	100	500	1000		**0.043 J**	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**3.5 J**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**0.63 J**	0.39 U	0.38 U
Anthracene		120-12-7	100	100	500	1000		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**19**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**3.3**	0.39 U	0.38 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.42 UJ	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**17**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**2.5**	0.39 U	0.38 U
Fluoranthene		206-44-0	100	100	500	1000		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**63**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	**0.044 J**	**17**	0.39 U	0.38 U
Fluorene		86-73-7	30	100	500	1000		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**13**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	**0.65 J**	0.39 U	0.38 U
Naphthalene		91-20-3	12	100	500	1000		0.42 U	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**8.2**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	0.35 U	1.7 U	0.39 U	0.38 U
Phenanthrene		85-01-8	100	100	500	1000		**0.047 J**	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**77**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	**0.039 J**	**8**	0.39 U	0.38 U
Pyrene		129-00-0	100	100	500	1000		**0.056 J**	0.4 U	0.36 U	0.35 U	0.37 U	0.4 U	**51**	0.34 U	0.4 U	0.34 U	0.41 U	0.4 U	0.37 U	0.46 U	0.41 U	**0.05 J**	**14**	0.39 U	0.38 U
Total Non-Carcinogenic PAHs								**0.146**	0	0	0	0	0	**271.2**	0	0	0	0	0	0	0	0	**0.133**	**46.08**	0	0
Total PAHs								**0.146**	0	0	0	0	0	**408.4**	0	0	0	0	0	0	0	0	**0.226**	**87.78**	0	0
Other Semivolatile Organic Compounds	ug/lg																									
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	6800 U	NA	33 U	NA	33 U	NA	NA	NA	NA	NA	NA	NA	380 U
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	6800 U	NA	33 U	NA	33 U	NA	NA	NA	NA	NA	NA	NA	380 U
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	6800 U	NA	33 U	NA	33 U	NA	NA	NA	NA	NA	NA	NA	380 U
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
Carbazole		86-74-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**9000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		420 U	400 U	360 U	350 U	370 U	400 U	**12000**	340 U	400 U	340 U	410 U	400 U	370 U	460 U	410 U	350 U	1700 U	390 U	380 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	6800 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	380 U
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	13 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																									
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**428**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	0.31 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		NA	NA	NA	NA	NA	**1.1 B**	**0.94 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Barium		7440-39-3	350	400	400	10000		NA	NA	NA	NA	NA	**4.9 B**	**2 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	NA	NA	NA	NA	0.21 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		NA	NA	NA	NA	NA	0.044 U	0.041 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**96.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		NA	NA	NA	NA	NA	**2.4**	**1.5 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**1.2 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	NA	NA	NA	NA	**3.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**1520**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		NA	NA	NA	NA	NA	**1.3**	**13.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**88**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	NA	NA	NA	NA	**36**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		NA	NA	NA	NA	NA	0.018 U	0.017 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel		7440-02-0	30	310	310	10000		NA	NA	NA	NA	NA	NA	**1.3 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**76.4 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		NA	NA	NA	NA	NA	**0.66 B**	0.41 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver		7440-22-4	2	180	1500	6800		NA	NA	NA	NA	NA	0.22 U	0.21 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**82.6 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	0.31 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	**1.6 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	NA	NA	NA	NA	**26**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																									
Cyanide, total		57-12-5	27	27	27	10,000		NA	**0.65 B**	**0.53 B**	7 U	**0.44 B**	**0.3 B**	**0.32 B**	**0.27 B**	**0.13 B**	**0.59 B**	**0.48 B**	**1.7**	**2.1**	**0.56 B**	**0.22 B**	**3.4**	**0.52 B**	**0.28 B**	NA

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-73	RPGP-28A	RPSB-55	RPSB-56	RPMW-16I	RPSB-100	RPSB-101	RPSB-102	RPSB-58	RPSB-59	RPSB-61	RPSB-62	RPSB-77	RPSB-77	RPSB-77	RPSB-78	RPSB-78	RPSB-78	RPSB-79
						Sample Name	RPSB-73 (12-14)	RPGP-28A (40-44)	RPSB-55 (40-42)	RPSB-56 (40-42)	RPMW-16I (9-11)	RPSB-100 (4-6)	RPSB-101 (5-7)	RPSB-102 (5-7)	RPSB-58 (4-6)	RPSB-59 (5-7)	RPSB-61 (10-12)	RPSB-62 (5-7)	RPSB-77 (4-6)	RPSB-77 (6-8)	RPSB-77 (8-10)	RPSB-78 (4-6)	RPSB-78 (6-8)	RPSB-78 (8-10)	RPSB-79 (8-10)
						Start Depth	12	40	40	40	9-11	4-6	5-7	5-7	4-6	5-7	10-12	5-7	4-6	6-8	8-10	4-6	6-8	8-10	8-10
						End Depth	14	44	42	42	9-11	4-6	5-7	5-7	4-6	5-7	10-12	5-7	4-6	6-8	8-10	4-6	6-8	8-10	8-10
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	02/25/2000	07/24/2002	03/06/2000	03/06/2000	10/24/2002	11/08/2001	11/15/2001	11/28/2001	01/26/2000	02/15/2000	02/10/2000	02/11/2000	02/28/2000	02/28/2000	02/28/2000	02/29/2000	02/29/2000	02/29/2000	03/01/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																			
BTEX	mg/kg																								
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.018**	**0.002**	**0.013**	0.001 U	**20**	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.006**	0.001 U	**0.004**	0.001 U	**190**	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Toluene		108-88-3	0.7	100	500	1000	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.003**	**0.045**	**0.016**	**0.04**	0.001 U	**180**	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.013**	**0.001**	**0.02**	0.001 U	**2400**	0.005 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.001**	**0.002**	0.001 U
Total BTEX							0	0	0	0	0	**0.003**	**0.082**	**0.019**	**0.077**	0	**2790**	0	0	0	0	0	**0.001**	**0.006**	0
Volatile Organic Compounds	ug/kg																								
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	5 U	NA	5 U
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4 JB**	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	5 U	NA	5 U
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**3 J**	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	5 U	NA	5 U
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	5 U	NA	5 U
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																								
Carcinogenic PAHs																									
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.4 U	0.42 U	0.41 U	0.41 U	**0.054 J**	0.41 U	**0.62**	**1.6**	0.39 U	0.43 U	**1.2 J**	**0.13 J**	**0.078 J**	**0.52**	0.41 U	0.38 U	**0.42**	1.7 U	3.4 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.4 U	0.42 UJ	0.41 U	0.41 U	**0.1 J**	0.41 U	**0.59**	**2.6**	0.39 U	0.43 U	**0.51 J**	**0.057 J**	**0.075 J**	**0.48**	0.41 U	0.38 U	**0.29 J**	1.7 U	3.4 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.4 U	0.42 UJ	0.41 U	0.41 U	**0.14 J**	0.41 U	**1.1**	**3.8**	0.39 U	0.43 U	**0.77 J**	**0.12 J**	**0.15 J**	**0.96**	0.41 U	0.38 U	**1**	1.7 U	3.4 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.4 U	0.42 UJ	0.41 U	0.41 U	**0.054 J**	0.41 U	**0.4**	**1.4**	0.39 U	0.43 U	**0.36 J**	**0.039 J**	**0.087 J**	**0.36 J**	0.41 U	0.38 U	**0.27 J**	1.7 U	3.4 U
Chrysene		218-01-9	1	3.9	56	110	0.4 U	0.42 U	0.41 U	0.41 U	**0.059 J**	0.41 U	**0.94**	**2.6**	0.39 U	0.43 U	**1.3 J**	**0.16 J**	**0.12 J**	**0.83**	0.41 U	0.38 U	**0.82**	1.7 U	3.4 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.4 U	0.42 UJ	0.41 U	0.41 U	0.41 UJ	0.41 U	**0.17 J**	**0.58**	0.39 U	0.43 U	1.6 U	0.34 U	0.34 U	0.37 U	0.41 U	0.38 U	**0.15 J**	1.7 U	3.4 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.4 U	0.42 UJ	0.41 U	0.41 U	**0.076 J**	0.41 U	**0.56**	**2.3**	0.39 U	0.43 U	**0.31 J**	**0.052 J**	**0.047 J**	**0.38**	0.41 U	0.38 U	**0.55**	1.7 U	3.4 U
Total Carcinogenic PAHs							0	0	0	0	**0.483**	0	**4.38**	**14.88**	0	0	**4.45**	**0.558**	**0.557**	**3.53**	0	0	**3.5**	0	0
Non-Carcinogenic PAHs																									
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	0.41 U	**0.58**	**0.054 J**	0.39 U	0.43 U	**14**	0.34 U	0.34 U	0.37 U	0.41 U	0.38 U	**0.087 J**	1.7 U	3.4 U
Acenaphthene		83-32-9	20	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	**0.034 J**	0.38 U	0.39 U	0.39 U	0.43 U	**0.94 J**	0.34 U	0.34 U	0.37 U	0.41 U	0.38 U	0.34 U	1.7 U	3.4 U
Acenaphthylene		208-96-8	100	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	**0.23 J**	**0.31 J**	**0.74**	0.39 U	0.43 U	**1 J**	**0.054 J**	0.34 U	**0.081 J**	0.41 U	0.38 U	**0.42**	1.7 U	3.4 U
Anthracene		120-12-7	100	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	**0.11 J**	**0.14 J**	**0.31 J**	0.39 U	0.43 U	**1.3 J**	**0.068 J**	0.34 U	**0.089 J**	0.41 U	0.38 U	**0.14 J**	1.7 U	3.4 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.4 U	0.42 UJ	0.41 U	0.41 U	**0.079 J**	**0.081 J**	**0.65**	**2.3**	0.39 U	0.43 U	**0.31 J**	**0.075 J**	0.34 U	**0.34 J**	0.41 U	0.38 U	**0.45**	1.7 U	3.4 U
Fluoranthene		206-44-0	100	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	**0.081 J**	0.41 U	**0.87**	**2.2**	0.39 U	0.43 U	**3.1**	**0.19 J**	**0.09 J**	**0.96**	0.41 U	0.38 U	**0.57**	1.7 U	3.4 U
Fluorene		86-73-7	30	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	0.41 U	**0.044 J**	**0.086 J**	0.39 U	0.43 U	**3.6**	0.34 U	0.34 U	0.37 U	0.41 U	0.38 U	0.34 U	1.7 U	3.4 U
Naphthalene		91-20-3	12	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	0.41 U	**2.1**	**0.086 J**	0.39 U	0.43 U	**46 D**	0.005 U	0.34 U	0.37 U	0.41 U	0.38 U	**0.13 J**	1.7 U	3.4 U
Phenanthrene		85-01-8	100	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	0.41 U	0.41 U	**0.54**	**0.86**	0.39 U	**0.14 J**	**10**	**0.36**	**0.05 J**	**0.42**	0.41 U	0.38 U	**0.52**	1.7 U	3.4 U
Pyrene		129-00-0	100	100	500	1000	0.4 U	0.42 U	0.41 U	0.41 U	**0.084 J**	0.41 U	**1.2**	**3.8**	0.39 U	**0.088 J**	**4**	**0.29 J**	**0.13 J**	**1.2**	0.41 U	0.38 U	**1.3**	1.7 U	3.4 U
Total Non-Carcinogenic PAHs							0	0	0	0	**0.244**	**0.421**	**6.468**	**10.436**	0	**0.228**	**84.25**	**1.037**	**0.27**	**3.09**	0	0	**3.617**	0	0
Total PAHs							0	0	0	0	**0.727**	**0.421**	**10.848**	**25.316**	0	**0.228**	**88.7**	**1.595**	**0.827**	**6.62**	0	0	**7.117**	0	0
Other Semivolatile Organic Compounds	ug/lg																								
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	33 U	NA	33 U
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	33 U	NA	33 U
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	33 U	NA	33 U
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	400 U	420 U	410 U	410 U	410 U	410 U	**47 J**	380 U	390 U	430 U	**770 J**	340 U	340 U	370 U	410 U	380 U	**35 J**	1700 U	3400 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340 U	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																								
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**212**	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.26 U	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	NA	NA	**1 B**	**1.1 B**	NA	NA	NA	NA	**0.41 B**	**0.36 B**	0.43 U	0.35 U	NA	NA	NA	NA	NA	NA	NA
Barium		7440-39-3	350	400	400	10000	NA	NA	**1.8 B**	**1.7 B**	NA	NA	NA	NA	**7.4 B**	**2.9 B**	**1.9 B**	**2.2 B**	NA	NA	NA	NA	NA	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.18 U	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	NA	NA	NA	NA	NA	NA	NA	NA	0.18 U	0.032 U	0.043 U	0.035 U	NA	NA	NA	NA	NA	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**81.1**	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	NA	NA	**1.8 B**	**2.4**	NA	NA	NA	NA	**2.7**	**2**	**2.6**	**1.4 B**	NA	NA	NA	NA	NA	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.46 B**	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.7**	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**816**	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	NA	NA	**0.85 B**	**0.9 B**	NA	NA	NA	NA	**21**	**1.4**	**6.1**	**15**	NA	NA	NA	NA	NA	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**75.3**	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**21**	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	NA	NA	NA	NA	NA	NA	NA	NA	0.20 U	0.019 U	0.019 U	**0.016 B**	NA	NA	NA	NA	NA	NA	NA
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.6 B**	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**78.7 B**	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	NA	NA	NA	NA	NA	NA	NA	NA	0.36 U	0.32 U	**0.95 B**	**0.61 B**	NA	NA	NA	NA	NA	NA	NA
Silver		7440-22-4	2	180	1500	6800	NA	NA	NA	NA	NA	NA	NA	NA	0.27 U	**0.57 B**	0.22 U	0.18 U	NA	NA	NA	NA	NA	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**44.4 B**	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.26 U	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1.4 B**	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**10.2**	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																								
Cyanide, total		57-12-5	27	27	27	10,000	**0.26 B**	NA	0.2 U	**0.27 B**	0.29 U	7 U	**0.36 B**	**2.3**	**0.27 B**	0.095 U	**0.29 B**	**0.94**	**2**	**3.2**	**0.63 B**	0.17 U	**2.4**	**0.43 B**	0.15 U

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-79	RPSB-80	RPSB-80	RPSB-80	RPSB-81	RPSB-81	RPSB-81	RPSB-82	RPSB-82	RPSB-82	RPSB-98	RPSB-98A	RPSB-99	RPGP-26	RPGP-27	RPSB-101	RPSB-127	RPSB-127	RPSB-57
						Sample Name	RPSB-79 (10-12)	RPSB-80 (4-6)	RPSB-80 (6-8)	RPSB-80 (8-10)	RPSB-81 (4-6)	RPSB-81 (6-8)	RPSB-81 (8-10)	RPSB-82 (4-6)	RPSB-82 (6-8)	RPSB-82 (8-10)	RPSB-98 (4-6)	RPSB-98A (6-8)	RPSB-99 (6-8)	RPGP-26 (20-24)	RPGP-27 (12-16)	RPSB-101 (15-17)	RSB-127 (14.5-17)	RPSB-127 (21-23)	RPSB-57 (15-17)
						Start Depth	10-12	4-6	6-8	8-10	4-6	6-8	8-10	4-6	6-8	8-10	4-6	6-8	6-8	20-24	12-16	15-17	14.5-17	21-23	15-17
						End Depth	10-12	4-6	6-8	8-10	4-6	6-8	8-10	4-6	6-8	8-10	4-6	6-8	6-8	20-24	12-16	15-17	14.5-17	21-23	15-17
						Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
						Sample Date	03/01/2000	03/01/2000	03/01/2000	03/01/2000	03/01/2000	03/01/2000	03/01/2000	03/02/2000	03/02/2000	03/02/2000	11/07/2001	11/09/2001	11/14/2001	07/19/2002	07/23/2002	11/15/2001	08/26/2002	08/26/2002	02/24/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																			
BTEX	mg/kg																								
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	**0.03**	**0.14**	1.3 U	**0.24**	0.001 U	0.001 U	**0.05**	0.001 U	0.001 U	**0.001**	0.001 U	**0.036**	0.001 U	**0.067**	0.001 U	**0.2 J**	**0.001 J**	0.001 U
Ethyl benzene		100-41-4	1	41	390	780	**0.077**	**0.013**	**0.4**	**33**	0.005 U	0.001 U	0.001 U	0.01 U	0.001 U	0.001 U	**0.004**	0.001 U	**0.041**	0.001 U	**0.035**	0.001 U	**0.11**	**0.002**	0.001 U
Toluene		108-88-3	0.7	100	500	1000	**0.003**	**0.013**	**0.14**	**3.2**	**0.059**	0.001 U	0.001 U	**0.08**	0.001 U	0.001 U	0.001 U	**0.001**	**0.059**	0.001 U	0.001 U	0.001 U	**0.011**	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000	**0.19**	**0.016**	**0.5**	**100**	**0.008**	0.001 U	0.001 U	**0.029**	0.001 U	0.001 U	**0.016**	0.001 U	**0.066**	0.001 U	**0.05**	0.001 U	**0.063**	0.001 U	0.001 U
Total BTEX							**0.27**	**0.072**	**1.18**	**136.2**	**0.307**	0	0	**0.159**	0	0	**0.021**	**0.001**	**0.202**	0	**0.152**	0	**0.384**	**0.003**	0
Volatile Organic Compounds	ug/kg																								
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	5 U	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	5 U	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	5 U	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	5 U	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																								
Carcinogenic PAHs																									
Benzo(a)anthracene		56-55-3	1	1	5.6	11	3.4 U	1.8 U	**0.53 J**	**0.68 J**	**1.1 J**	0.34 U	0.39 U	**0.12 J**	0.39 U	0.39 U	0.38 U	**0.1 J**	**0.28 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1	**14**	1.8 U	**0.47 J**	**0.65 J**	**0.97 J**	0.34 U	0.39 U	**0.094 J**	0.39 U	0.39 U	0.38 U	**0.19 J**	**0.38**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	**5.7**	1.8 U	**1.1 J**	**0.8 J**	**1.6 J**	0.34 U	0.39 U	**0.13 J**	0.39 U	0.39 U	0.38 U	**0.2 J**	**0.66**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	**0.83 J**	1.8 U	**0.33 J**	**0.3 J**	**0.43 J**	0.34 U	0.39 U	**0.067 J**	0.39 U	0.39 U	0.38 U	**0.091 J**	**0.31 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Chrysene		218-01-9	1	3.9	56	110	**1.1 J**	1.8 U	**0.72 J**	**0.7 J**	**1.3 J**	0.34 U	0.39 U	**0.15 J**	0.39 U	0.39 U	0.38 U	**0.11 J**	**0.4**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	**2.2 J**	1.8 U	1.8 U	1.7 U	3.5 U	0.34 U	0.39 U	0.34 U	0.39 U	0.39 U	0.38 U	0.41 U	0.35 U	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	**12**	1.8 U	**0.42 J**	1.7 U	3.5 U	0.34 U	0.39 U	**0.063 J**	0.39 U	0.39 U	0.38 U	**0.16 J**	**0.32 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Total Carcinogenic PAHs							**35.83**	0	**3.57**	**3.13**	**5.4**	0	0	**0.624**	0	0	0	**0.851**	**2.35**	0	0	0	0	0	0
Non-Carcinogenic PAHs																									
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	3.4 U	1.8 U	**0.62 J**	**1.6 J**	3.5 U	0.34 U	0.39 U	0.34 U	0.39 U	0.39 U	0.38 U	0.41 U	**0.24 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Acenaphthene		83-32-9	20	100	500	1000	3.4 U	1.8 U	1.8 U	1.7 U	3.5 U	0.34 U	0.39 U	0.34 U	0.39 U	0.39 U	0.38 U	0.41 U	**0.098 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Acenaphthylene		208-96-8	100	100	500	1000	**6**	1.8 U	**0.39 J**	**0.42 J**	**0.68 J**	0.34 U	0.39 U	0.34 U	0.39 U	0.39 U	0.38 U	**0.4 J**	**0.58**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Anthracene		120-12-7	100	100	500	1000	**1.3 J**	1.8 U	1.8 U	1.7 U	**0.44 J**	0.34 U	0.39 U	0.34 U	0.39 U	0.39 U	0.38 U	**0.11 J**	**0.16 J**	0.42 UJ	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	**13**	1.8 U	**0.46 J**	**0.34 J**	3.5 U	0.34 U	0.39 U	**0.058 J**	0.39 U	0.39 U	0.38 U	**0.18 J**	**0.3 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Fluoranthene		206-44-0	100	100	500	1000	3.4 U	1.8 U	**1 J**	**0.58 J**	**1.3 J**	0.34 U	0.39 U	**0.22 J**	0.39 U	0.39 U	0.38 U	**0.13 J**	**0.37**	0.42 UJ	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Fluorene		86-73-7	30	100	500	1000	3.4 U	1.8 U	1.8 U	**0.2 J**	3.5 U	0.34 U	0.39 U	0.34 U	0.39 U	0.39 U	0.38 U	**0.071 J**	**0.12 J**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Naphthalene		91-20-3	12	100	500	1000	3.4 U	1.8 U	**12**	**9**	**0.48 J**	0.079 J	0.39 U	**0.56**	0.39 U	0.39 U	0.38 U	**0.16 J**	**0.48**	0.42 U	0.4 U	0.33 U	0.41 UJ	0.37 U	0.42 U
Phenanthrene		85-01-8	100	100	500	1000	3.4 U	1.8 U	**0.8 J**	**0.42 J**	**1.4 J**	0.34 U	0.39 U	**0.078 J**	0.39 U	0.39 U	0.38 U	**0.12 J**	**0.26 J**	0.42 UJ	0.4 U	**0.037 J**	0.41 UJ	0.37 U	0.42 U
Pyrene		129-00-0	100	100	500	1000	3.4 U	1.8 U	**1.3 J**	**2.8**	**2.8 J**	0.34 U	0.39 U	**0.16 J**	0.39 U	0.39 U	0.38 U	**0.17 J**	**0.46**	0.42 U	0.4 UJ	0.33 U	0.41 UJ	0.37 U	0.42 U
Total Non-Carcinogenic PAHs							**20.3**	0	**16.57**	**15.36**	**7.1**	**0.079**	0	**1.076**	0	0	0	**1.341**	**3.068**	0	0	**0.037**	0	0	0
Total PAHs							**56.13**	0	**20.14**	**18.49**	**12.5**	**0.079**	0	**1.7**	0	0	0	**2.192**	**5.418**	0	0	**0.037**	0	0	0
Other Semivolatile Organic Compounds	ug/lg																								
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	33 U	NA	NA	33 U	NA	NA	33 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	33 U	NA	NA	33 U	NA	NA	33 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	33 U	NA	NA	33 U	NA	NA	33 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	**12000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	3400 U	1800 U	1800 U	1700 U	3500 U	340 U	390 U	340 U	390 U	390 U	380 U	**54 J**	350 U	420 U	400 U	330 U	410 UJ	370 U	420 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																								
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.65 B**
Barium		7440-39-3	350	400	400	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.8 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.13 B**
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.2 B**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.019 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.49 U
Silver		7440-22-4	2	180	1500	6800	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.24 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																								
Cyanide, total		57-12-5	27	27	27	10,000	0.12 U	**0.66 B**	**0.99**	0.12 U	**5.1**	0.14 U	0.21 U	**0.33 B**	**0.25 B**	0.21 U	7 U	**1.6**	**0.38 B**	NA	NA	**0.80 B**	0.3 U	0.24 U	**0.18 B**

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-60	RPSB-63	RPSB-98A	RPGP-27	RPMW-16I	RPSB-100	RPSB-101	RPSB-102	RPSB-57	RPSB-58	RPSB-59	RPSB-60	RPSB-62	RPSB-98	RPSB-99	RPSB-127	RPSB-61
							Sample Name	RPSB-60 (15-17)	RPSB-63 (15-17)	RPSB-98A (18-20)	RPGP-27 (36-40)	RPMW-16I (39-41)	RPSB-100 (36-38)	RPSB-101 (39-41)	RPSB-102 (29-31)	RPSB-57 (40-42)	RPSB-58 (40-42)	RPSB-59 (40-42)	RPSB-60 (40-42)	RPSB-62 (40-42)	RPSB-98 (38-40)	RPSB-99 (38-40)	RPSB-127 (57-67)	RPSB-61 (55-57)
							Start Depth	15-17	15-17	18-20	36-40	39-41	36-38	39-41	29-31	40-42	40-42	40-42	40-42	40-42	38-40	38-40	57-67	55-57
							End Depth	15-17	15-17	18-20	36-40	39-41	36-38	39-41	29-31	40-42	40-42	40-42	40-42	40-42	38-40	38-40	57-67	55-57
							Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
							Sample Date	02/07/2000	02/23/2000	11/09/2001	07/25/2002	10/24/2002	11/08/2001	11/15/2001	11/28/2001	02/24/2000	01/31/2000	02/15/2000	02/07/2000	02/11/2000	11/08/2001	11/14/2001	08/26/2002	02/10/2000
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																		
BTEX	mg/kg																							
Benzene		71-43-2	0.06	4.8	44	89		0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.003**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002 J**	0.001 U
Ethyl benzene		100-41-4	1	41	390	780		0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.008 J**	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U
Toluene		108-88-3	0.7	100	500	1000		0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	**0.012**	0.001 U	**0.003**	0.001 U	**0.002**	**0.004**	**0.002**	**0.002**
Xylene (total)		1330-20-7	0.26	100	500	1000		**0.004**	0.001 U	**0.001**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.009**	0.001 U	**0.012**	**0.003**	0.001 U	**0.006**	0.001 U	**0.006**
Total BTEX								**0.004**	0	**0.005**	0	0	**0.002**	0	0	0	**0.032**	0	**0.015**	**0.003**	**0.002**	**0.012**	**0.004**	**0.008**
Volatile Organic Compounds	ug/kg																							
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																							
Carcinogenic PAHs																								
Benzo(a)anthracene		56-55-3	1	1	5.6	11		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.053 J**	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Chrysene		218-01-9	1	3.9	56	110		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.07 J**	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Total Carcinogenic PAHs								0	0	0	NA	0	0	0	0	0	**0.123**	0	0	0	0	0	0	0
Non-Carcinogenic PAHs																								
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		**0.11 J**	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	**0.067 J**	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Acenaphthene		83-32-9	20	100	500	1000		**0.074 J**	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.047 J**	0.45 U	**0.054 J**	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Acenaphthylene		208-96-8	100	100	500	1000		**0.051 J**	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.06 J**	0.45 U	**0.048 J**	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Anthracene		120-12-7	100	100	500	1000		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.064 J**	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Fluoranthene		206-44-0	100	100	500	1000		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.14 J**	0.45 U	**0.04 J**	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Fluorene		86-73-7	30	100	500	1000		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.081 J**	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Naphthalene		91-20-3	12	100	500	1000		0.38 U	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	0.4 U	0.45 U	0.41 U	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Phenanthrene		85-01-8	100	100	500	1000		**0.1 J**	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.44**	**0.07 J**	**0.13 J**	0.41 U	0.4 U	0.42 U	0.39 U	**0.066 J**
Pyrene		129-00-0	100	100	500	1000		**0.04 J**	0.39 U	0.37 U	NA	0.41 U	0.4 U	0.32 U	0.42 U	0.4 U	**0.2 J**	0.45 U	**0.056 J**	0.41 U	0.4 U	0.42 U	0.39 U	0.4 U
Total Non-Carcinogenic PAHs								**0.375**	0	0	NA	0	0	0	0	0	**1.032**	**0.07**	**0.395**	0	0	0	0	**0.066**
Total PAHs								**0.375**	0	0	NA	0	0	0	0	0	**1.155**	**0.07**	**0.395**	0	0	0	0	**0.066**
Other Semivolatile Organic Compounds	ug/lg																							
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		380 U	390 U	370 U	NA	410 U	400 U	320 U	420 U	400 U	400 U	450 U	410 U	410 U	400 U	420 U	390 U	400 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals	mg/kg																							
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		**0.55 B**	0.39 U	NA	NA	NA	NA	NA	NA	**0.88 B**	**0.54 B**	**1.3 B**	**0.72 B**	0.39 U	NA	NA	NA	**0.5 B**
Barium		7440-39-3	350	400	400	10000		**0.95 B**	**1.7 B**	NA	NA	NA	NA	NA	NA	**2 B**	**1.7 B**	**2.3 B**	**1.6 B**	**1.7 B**	NA	NA	NA	**1 B**
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		0.22 U	**0.072 B**	NA	NA	NA	NA	NA	NA	**0.097 B**	0.22 U	0.043 U	0.23 U	0.039 U	NA	NA	NA	**0.043 B**
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		**1.2 B**	**1.1 B**	NA	NA	NA	NA	NA	NA	**2.1 B**	**2.7**	**1.8 B**	**2.5**	**1.8 B**	NA	NA	NA	**1.4 B**
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		**0.38 B**	**0.89 B**	NA	NA	NA	NA	NA	NA	**1**	**0.56 B**	**0.55 B**	**0.6 B**	**0.69 B**	NA	NA	NA	**0.41 B**
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		0.015 U	0.02 U	NA	NA	NA	NA	NA	NA	0.02 U	0.019 U	0.02 U	0.021 U	0.018 U	NA	NA	NA	0.02 U
Nickel		7440-02-0	30	310	310	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		0.43 U	0.39 U	NA	NA	NA	NA	NA	NA	0.47 U	0.44 U	**0.64 B**	0.46 U	0.39 U	NA	NA	NA	**0.68 B**
Silver		7440-22-4	2	180	1500	6800		0.32 U	0.2 U	NA	NA	NA	NA	NA	NA	0.23 U	0.33 U	**0.33 B**	0.35 U	0.19 U	NA	NA	NA	**0.25 B**
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																							
Cyanide, total		57-12-5	27	27	27	10,000		**0.073 B**	**0.12 B**	7 U	NA	0.29 U	7 U	0.41 U	0.30 U	0.093 U	**0.13 B**	**0.22 B**	**0.056 B**	0.13 U	7 U	**3.3**	0.28 U	0.069 U

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	RPSB-63	RPSS-04	SS-09B	B-13	B-13	B-16	GP-31	GP-32	GP-33	GP-34	GP-34	RPSB-105	RPSB-108	RPSB-14	RPSB-14	RPSB-64
							Sample Name	RPSB-63 (45-47)	RPSS-04 (0-6")	RPSS09	RB-112498-B13	RB-112498-B13	RB-112498-B16	GP-31	GP-32	GP-33	GP-34	GP34 (8-10)	RPSB-105 (4-6)	RPSB-108 (4-6)	RPSB-14 (0-2)	RPSB-14 (6-8)	RPSB-64 (4-6)
							Start Depth	45-47	0-0.5	0.25	8.35	10.00	10.00	2.25	6.40	6.00	6.00	8-10	4-6	4-6	0-2	6-8	4-6
							End Depth	45-47	0-0.5	0.25	8.35	10.00	10.00	2.25	6.40	6.00	6.00	8-10	4-6	4-6	0-2	6-8	4-6
							Depth Unit	ft	0-0.5	0.25	8.35	10.00	10.00	2.25	6.40	6.00	6.00	8-10	4-6	4-6	0-2	6-8	4-6
							Sample Date	02/23/2000	01/04/2000	10/23/1995	11/24/1998	11/24/1998	11/24/1998	12/30/1998	12/30/1998	12/30/1998	12/30/1998	12/30/1998	11/06/2001	11/06/2001	12/13/1999	12/13/1999	10/11/1999
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**																	
BTEX	mg/kg																						
Benzene		71-43-2	0.06	4.8	44	89		0.001 U	0.001 U	**0.006**	1.5 U	NA	NA	0.005 U	0.006 U	0.006 U	0.006 U	0.006 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780		0.001 U	0.001 U	0.005 U	**2.3**	NA	NA	0.005 U	0.006 U	0.006 U	0.006 U	0.006 U	0.001 U	0.001 U	**0.014**	0.001 U	0.001 U
Toluene		108-88-3	0.7	100	500	1000		0.001 U	0.001 U	**0.01**	**1.2 J**	NA	NA	0.005 U	0.006 U	0.006 U	0.006 U	0.006 U	0.001 U	0.001 U	**0.016**	0.001 U	0.001 U
Xylene (total)		1330-20-7	0.26	100	500	1000		0.001 U	0.001 U	0.005 U	**28**	NA	NA	0.005 U	0.006 U	0.006 U	0.006 U	0.006 U	0.001 U	0.001 U	**0.065**	**0.004**	0.001 U
Total BTEX								0	0	**0.016**	**31.5**	NA	NA	0	0	0	0	0	0	0	**0.097**	**0.004**	0
Volatile Organic Compounds	ug/kg																						
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		NA	NA	10 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5 B**	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**25**	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**13**	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1 J**	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**160**	NA	NA
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5 U	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**8**	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		NA	NA	5 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**1 J**	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**3 J**	NA	NA
Semivolatile Organic Compounds	mg/kg																						
Carcinogenic PAHs																							
Benzo(a)anthracene		56-55-3	1	1	5.6	11		0.38 U	**7.6**	**0.098 J**	NA	0.42 U	0.4 U	**0.046 J**	0.40 U	**0.004 J**	0.40 U	**0.004 J**	0.39 U	0.4 U	**4.8**	0.41 U	0.34 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1		0.38 U	**5.7**	**0.086 J**	NA	0.42 U	0.4 U	**0.035 J**	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	**4.9**	0.41 U	0.34 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.38 U	**6.7**	**0.12 J**	NA	0.42 U	0.4 U	**0.023 J**	0.40 U	**0.002 J**	0.40 U	0.4 U	0.39 U	0.4 U	**5.7**	0.41 U	0.34 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.38 U	**2.4 J**	**0.15 J**	NA	0.42 U	0.4 U	**0.037 J**	0.40 U	**0.004 J**	0.40 U	0.4 U	0.39 U	0.4 U	**2.9 J**	0.41 U	0.34 U
Chrysene		218-01-9	1	3.9	56	110		0.38 U	**8.3**	**0.17 J**	NA	0.42 U	0.4 U	**0.051 J**	0.40 U	**0.003 J**	0.40 U	**0.002 J**	0.39 U	0.4 U	**5.4**	**0.043 J**	0.34 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.38 U	**1.4 J**	0.35 U	NA	0.42 U	0.4 U	0.34 U	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	**0.94 J**	0.41 U	0.34 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.38 U	**4.3**	**0.15 J**	NA	0.42 U	0.4 U	**0.02 J**	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	**3.2 J**	0.41 U	0.34 U
Total Carcinogenic PAHs								0	**36.4**	**0.774**	NA	0	0	**0.212**	0	**0.013**	0	**0.006**	0	0	**27.84**	**0.043**	0
Non-Carcinogenic PAHs																							
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		0.38 U	**1.9 J**	0.35 U	NA	0.42 U	0.4 U	0.34 U	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	**0.56 J**	0.41 U	0.34 U
Acenaphthene		83-32-9	20	100	500	1000		0.38 U	3.5 U	0.35 U	NA	**0.061 J**	0.4 U	**0.006 J**	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	3.4 U	0.41 U	0.34 U
Acenaphthylene		208-96-8	100	100	500	1000		0.38 U	**4.7**	**0.076 J**	NA	0.42 U	0.4 U	**0.02 J**	0.40 U	**0.004 J**	0.40 U	**0.003 J**	0.39 U	0.4 U	**5.4**	0.41 U	0.34 U
Anthracene		120-12-7	100	100	500	1000		0.38 U	**2.6 J**	0.35 U	NA	0.42 U	0.4 U	**0.027 J**	0.40 U	**0.001 J**	**0.001 J**	0.4 U	0.39 U	0.4 U	**0.88 J**	0.41 U	0.34 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.38 U	**5.7**	**0.28 J**	NA	0.42 U	0.4 U	**0.027 J**	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	**3.6**	0.41 U	0.34 U
Fluoranthene		206-44-0	100	100	500	1000		0.38 U	**8**	**0.11 J**	NA	0.42 U	0.4 U	**0.061 J**	**0.002 J**	**0.002 J**	**0.003 J**	**0.003 J**	0.39 U	0.4 U	**3.1 J**	**0.064 J**	0.34 U
Fluorene		86-73-7	30	100	500	1000		0.38 U	**0.74 J**	0.35 U	NA	0.420 U	0.4 U	**0.042 J**	0.40 U	0.40 U	0.40 U	0.4 U	0.39 U	0.4 U	**0.58 J**	0.41 U	0.34 U
Naphthalene		91-20-3	12	100	500	1000		0.38 U	**2.6 J**	0.35 U	NA	**0.11 J**	0.4 U	**0.067 J**	**0.002 J**	**0.002 J**	**0.002 J**	0.4 U	0.39 U	0.4 U	**0.53 J**	0.41 U	0.34 U
Phenanthrene		85-01-8	100	100	500	1000		0.38 U	**5.1**	**0.096 J**	NA	**0.059 J**	0.4 U	**0.16 J**	**0.005 J**	**0.002 J**	**0.003 J**	0.4 U	0.39 U	0.4 U	**1.2 J**	**0.12 J**	0.34 U
Pyrene		129-00-0	100	100	500	1000		0.38 U	**16**	**0.25 J**	NA	**0.063 J**	0.4 U	**0.18 J**	**0.005 J**	**0.005 J**	**0.006 J**	**0.009 J**	0.39 U	0.4 U	**7.8**	**0.11 J**	0.34 U
Total Non-Carcinogenic PAHs								0	**47.34**	**0.812**	NA	**0.293**	0	**0.59**	**0.014**	**0.016**	**0.015**	**0.015**	0	0	**23.65**	**0.294**	0
Total PAHs								0	**83.74**	**1.586**	NA	**0.293**	0	**0.802**	**0.014**	**0.029**	**0.015**	**0.021**	0	0	51.49	**0.337**	0
Other Semivolatile Organic Compounds	ug/lg																						
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	11000 U	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	12000 U	12000 U	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	NA	**140 J**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		380 U	3500 U	350 U	NA	NA	NA	NA	NA	NA	NA	NA	390 U	400 U	3400 U	410 U	340 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	NA	350 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3400 U	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE		NA															
Metals	mg/kg																						
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	**934**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**415**	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	**1.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.22 U	NA	NA
Arsenic		7440-38-2	13	16	16	16		0.47 U	**5.7**	**1.2**	**0.7 B**	NA	0.4 U	**1.7 B**	**0.91 B**	**2.1**	**1.1 B**	**1.2 B**	NA	NA	**4.9**	**0.61 B**	**0.57 B**
Barium		7440-39-3	350	400	400	10000		**2 B**	**29.7**	**11.9**	**13.4 B**	NA	**2.1 B**	**3.2 B**	**1.0 B**	**3.3 B**	**3.5 B**	**6.1 B**	NA	NA	**137**	**2.6 B**	**1.5 B**
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	**0.21**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.22 U	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		**0.1 B**	**1.4**	**0.37**	**0.1 B**	NA	0.07 U	**0.22 B**	0.21 U	0.2 U	0.21 U	0.21 U	NA	NA	**0.5 B**	0.21 U	**0.24 B**
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	**4580**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**108**	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		**2.3 B**	**6.4**	**3.9**	**7**	NA	**1.6 B**	**4.8**	**4.1**	**4.3**	**4.5**	**4**	NA	NA	**4.3**	**2.8**	**4.7**
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	**1.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**0.9 B**	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	**9.0**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7.3**	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	**3000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**6020**	NA	NA
Lead		7439-92-1	63	400	1000	3900		**0.96**	**136**	**30.9**	**2.1**	NA	**2.4**	**2.3**	0.43 U	**0.6 B**	**0.67**	**0.99**	NA	NA	**9**	**1.1**	**0.84 B**
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	**2580**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**153**	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	**34.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**10**	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		0.019 U	**0.072**	**0.05**	0.1 U	NA	0.1 U	0.037 U	0.049 U	0.028 U	0.054 U	0.049 U	NA	NA	**1.8**	0.018 U	0.049 U
Nickel		7440-02-0	30	310	310	10000		NA	NA	**3.0**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**3.8 B**	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	**211**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**122**	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		0.47 U	0.42 U	**0.62**	0.8 U	NA	0.8 U	0.56 U	**0.79 B**	0.6 U	0.63 U	**0.66 B**	NA	NA	**5.8**	**0.62 B**	**0.69 B**
Silver		7440-22-4	2	180	1500	6800		0.23 U	**2.3 B**	**0.42**	0.3 U	NA	0.3 U	0.19 U	0.21 U	0.2 U	0.21 U	0.21 U	NA	NA	**0.41 B**	0.32 U	**0.7 B**
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	**123**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	16.8 U	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	**1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.34 U	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	**5.1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**5.4 B**	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	**37.8**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7**	NA	NA
Total Cyanide	mg/kg																						
Cyanide, total		57-12-5	27	27	27	10,000		0.096 U	**5.5**	**1.43**	1.3 U	NA	1.2 U	**1.9**	**2.26**	**0.935**	**0.876**	**1.95**	7 U	7 U	**10.4**	**2.4 B**	**0.46 B**

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

						Location Name	RPSB-64	RPSB-65	RPSB-65	RPSB-66	RPSB-66	RPSB-71	RPSB-71	RPSB-71	RPSB-72	RPSB-72	RPSB-72	RPSB-88	RPSB-89	TP-11B	B-15
						Sample Name	RPSB-64 (10-12)	RPSB-65 (6-8)	RPSB-65 (10-12)	RPSB-66 (6-8)	RPSB-66 (10-12)	RPSB-71 (4-6)	RPSB-71 (6-8)	RPSB-71 (8-10)	RPSB-72 (4-6)	RPSB-72 (6-8)	RPSB-72 (8-10)	RPSB-88 (4-6)	RPSB-89 (7-9)	RPTP-11 (10-11)	RB-112498-B15
						Start Depth	10-12	6-8	10-12	6-8	10-12	4-6	6-8	8-10	4-6	6-8	8-10	4-6	7-9	10-11	14.00
						End Depth	10-12	6-8	10-12	6-8	10-12	4-6	6-8	8-10	4-6	6-8	8-10	4-6	7-9	10-11	14.00
						Depth Unit	10-12	6-8	10-12	6-8	10-12	4-6	6-8	8-10	4-6	6-8	8-10	4-6	7-9	10-11	14.00
						Sample Date	10/11/1999	10/12/1999	10/12/1999	10/12/1999	10/12/1999	03/03/2000	03/03/2000	03/03/2000	03/02/2000	03/02/2000	03/02/2000	11/01/2001	11/13/2001	10/25/1995	11/24/1998
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**															
BTEX	mg/kg																				
Benzene		71-43-2	0.06	4.8	44	89	0.001 U	0.001 U	0.001 U	0.001 U	**0.007**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.16 U	NA
Ethyl benzene		100-41-4	1	41	390	780	0.001 U	0.001 U	0.001 U	0.001 U	**0.11 D**	**0.001**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.16 U	NA
Toluene		108-88-3	0.7	100	500	1000	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.16 U	NA
Xylene (total)		1330-20-7	0.26	100	500	1000	0.001 U	0.001 U	0.001 U	**0.023**	**0.35**	**0.003**	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	**0.004**	0.001 U	0.16 U	NA
Total BTEX							0	0	0	**0.023**	**0.469**	**0.004**	0	**0.002**	0	0	0	**0.006**	0	0	NA
Volatile Organic Compounds	ug/kg																				
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000	NA	NA	NA	NA	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	160 U	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000	NA	NA	NA	NA	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	160 U	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000	NA	NA	NA	NA	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000	NA	NA	NA	NA	NA	NA	5 U	NA	NA	5 U	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																				
Carcinogenic PAHs																					
Benzo(a)anthracene		56-55-3	1	1	5.6	11	0.4 U	0.41 U	**0.092 J**	**8.1**	**0.42**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.048 J**	0.16 U	**0.059 J**
Benzo(a)pyrene		50-32-8	1	1	1	1.1	0.4 U	0.41 U	**0.098 J**	**4.2**	**0.25 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.058 J**	0.16 U	**0.075 J**
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11	0.4 U	0.41 U	**0.078 J**	**4.2**	**0.22 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.05 J**	0.16 U	**0.065 J**
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110	0.4 U	0.41 U	**0.04 J**	**2.1 J**	**0.085 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	0.4 U
Chrysene		218-01-9	1	3.9	56	110	0.4 U	0.41 U	**0.11 J**	**6.6**	**0.38 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.065 J**	0.16 U	**0.056 J**
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1	0.4 U	0.41 U	0.38 U	**0.37 J**	0.41 U	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	0.4 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11	0.4 U	0.41 U	0.38 U	**0.85**	**0.093 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	0.4 U
Total Carcinogenic PAHs							0	0	**0.418**	**26.42**	**1.448**	0	0	0	0	0	0	0	**0.221**	0	**0.255**
Non-Carcinogenic PAHs																					
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE	0.4 U	**0.15 J**	0.38 U	**1.3 J**	**0.31 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	0.4 U
Acenaphthene		83-32-9	20	100	500	1000	0.4 U	0.41 U	**0.052 J**	**11 J**	**1.8 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	**0.056 J**
Acenaphthylene		208-96-8	100	100	500	1000	0.4 U	0.41 U	**0.043 J**	**3.6 J**	**0.14 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.065 J**	0.16 U	0.4 U
Anthracene		120-12-7	100	100	500	1000	0.4 U	0.41 U	0.38 U	**5.5**	**0.48**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.071 J**	0.16 U	0.4 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000	0.4 U	0.41 U	0.38 U	**0.8**	**0.12 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	0.4 U
Fluoranthene		206-44-0	100	100	500	1000	0.4 U	0.41 U	**0.055 J**	**8.6**	**0.96**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.087 J**	0.16 U	0.4 U
Fluorene		86-73-7	30	100	500	1000	0.4 U	0.41 U	0.38 U	**10**	**0.75**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.054 J**	0.16 U	0.4 U
Naphthalene		91-20-3	12	100	500	1000	0.4 U	**0.11 J**	0.38 U	**2.8 J**	**3.1 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	0.4 U	0.16 U	0.4 U
Phenanthrene		85-01-8	100	100	500	1000	0.4 U	0.41 U	0.38 U	**10 J**	**2 J**	3.4 U	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.26 J**	0.16 U	0.4 U
Pyrene		129-00-0	100	100	500	1000	0.4 U	0.41 U	**0.15 J**	**12 J**	**1.2 J**	**0.37 J**	0.34 U	0.4 U	0.35 U	0.38 U	0.4 U	0.39 U	**0.19 J**	0.16 U	**0.094 J**
Total Non-Carcinogenic PAHs							0	**0.26**	**0.3**	**65.6**	**10.86**	**0.37**	0	0	0	0	0	0	**0.727**	0	**0.15**
Total PAHs							0	**0.26**	**0.718**	**92.02**	**12.308**	**0.37**	0	0	0	0	0	0	**0.948**	0	**0.405**
Other Semivolatile Organic Compounds	ug/lg																				
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.16 U	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000	400 U	410 U	380 U	740	97 J	3400 U	340 U	400 U	350 U	380 U	400 U	390 U	400 U	160 U	NA
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE															
Metals	mg/kg																				
Aluminum		7429-90-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16	**0.53 B**	**0.62 B**	**0.84 B**	**0.41 B**	**0.4 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.4 U
Barium		7440-39-3	350	400	400	10000	**3.8 B**	**2.5 B**	**4.5 B**	**2.7 B**	**5.3 B**	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.6 B**
Beryllium		7440-41-7	7.2	72	590	2700	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60	0.22 U	0.23 U	0.24 U	0.21 U	0.24 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.07 U
Calcium		7440-70-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE	**3.2**	**1.8 B**	**4.3**	**2.7**	**3.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.2 B**
Cobalt		7440-48-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900	**1.1 B**	**0.67 B**	**1.3**	**2.6**	**13.3**	NA	NA	NA	NA	NA	NA	NA	NA	NA	**4.2**
Magnesium		7439-95-4	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7	0.054 U	0.054 U	0.053 U	0.06 U	0.049 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.1 U
Nickel		7440-02-0	30	310	310	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800	0.45 U	0.47 U	0.47 U	0.43 U	0.48 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.8 U
Silver		7440-22-4	2	180	1500	6800	0.33 U	0.35 U	0.35 U	0.32 U	0.36 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.3 U
Sodium		7440-23-5	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																				
Cyanide, total		57-12-5	27	27	27	10,000	**0.43 B**	**1**	**2**	**0.94 B**	0.059 U	**1.8**	**0.56 B**	**1.2**	**2.5**	**0.46 B**	**0.71 B**	**3.1 ***	**0.51 B**	NA	1.2 U

Table 3C. Post Remediation Soil Impacts – Adjacent Properties
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

							Location Name	GP-30	RPSB-07	RPSB-08	RPSB-64	RPSB-65	RPSB-66	RPSB-07	RPSB-07	RPSB-08	RPSB-08	RPSB-14	RPSB-14	RPSB-89	RPSB-89
							Sample Name	GP30 (13-15)	RPSB-07 (15-17)	RPSB-08 (15-17)	RPSB-64 (14-16)	RPSB-65 (14-16)	RPSB-66 (14-16)	RPSB-07 (27-29)	RPSB-07 (39-41)	RPSB-08 (30-32)	RPSB-08 (40-42)	RPSB-14 (30-32)	RPSB-14 (40-42)	RPSB-89 (49-51)	RPSB-89 (59-61)
							Start Depth	13-15	15-17	15-17	14-16	14-16	14-16	27-29	39-41	30-32	40-42	30-32	40-42	49-51	59-61
							End Depth	13-15	15-17	15-17	14-16	14-16	14-16	27-29	39-41	30-32	40-42	30-32	40-42	49-51	59-61
							Depth Unit	13-15	15-17	15-17	14-16	14-16	14-16	27-29	39-41	30-32	40-42	30-32	40-42	49-51	59-61
							Sample Date	12/30/1998	12/13/1999	12/13/1999	10/11/1999	10/12/1999	10/12/1999	12/13/1999	12/13/1999	12/14/1999	12/14/1999	12/13/1999	12/13/1999	11/14/2001	11/14/2001
Analyte	**Units**	**CAS No.**	**Unrestricted SCO**	**Restricted Residential SCO**	**Commercial SCO**	**Industrial SCO**															
BTEX	mg/kg																				
Benzene		71-43-2	0.06	4.8	44	89		0.006 U	0.001 U	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U
Ethyl benzene		100-41-4	1	41	390	780		0.006 U	**0.001 J**	0.001 U	0.001 U	0.001 U	**0.11**	0.001 U	0.001 U	0.001 U	**0.007**	0.001 U	**0.002**	**0.019**	**0.001**
Toluene		108-88-3	0.7	100	500	1000		0.006 U	**0.002**	0.001 U	0.001 U	0.001 U	**0.002**	0.001 U	**0.004**	**0.002**	**0.002**	0.001 U	**0.003**	0.001 U	**0.002**
Xylene (total)		1330-20-7	0.26	100	500	1000		0.006 U	**0.006**	**0.002**	0.001 U	0.001 U	**0.12**	**0.003**	0.001 U	**0.005**	**0.009**	**0.002**	**0.007**	**0.006**	0.001 U
Total BTEX								0	**0.009**	**0.002**	0	0	**0.234**	**0.003**	**0.004**	**0.007**	**0.018**	**0.002**	**0.012**	**0.025**	**0.003**
Volatile Organic Compounds	ug/kg																				
1,2,3-Trichlorobenzene		87-61-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		78-93-3	120	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		591-78-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		67-64-1	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,2,4-trimethyl		95-63-6	3600	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1,3,5-trimethyl-		108-67-8	8400	52000	190000	380000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, 1-methylethyl- (Isopropylbenzene)		98-82-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		75-15-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		108-90-7	1,100	100,000	500,000	1,000,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		75-09-2	50	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene		104-51-8	12000		500000			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene		103-65-1	3900	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene		135-98-8	11000	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		100-42-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		127-18-4	1,300	19000	150000	300,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		79-01-6	470	21000	200000	400000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichlorofluoromethane		75-69-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	mg/kg																				
Carcinogenic PAHs																					
Benzo(a)anthracene		56-55-3	1	1	5.6	11		**0.009 J**	0.4 U	**0.05 J**	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	**0.053 J**	0.43 U	**0.041 J**	0.42 U	0.42 U	0.38 U
Benzo(a)pyrene		50-32-8	1	1	1	1.1		**0.007 J**	0.4 U	**0.045 J**	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	**0.04 J**	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Benzo(b)fluoranthene		205-99-2	1	1	5.6	11		0.41 U	0.4 U	**0.044 J**	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Benzo(k)fluoranthene		207-08-9	0.8	3.9	56	110		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Chrysene		218-01-9	1	3.9	56	110		**0.007 J**	0.4 U	**0.049 J**	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	**0.054 J**	0.43 U	**0.043 J**	0.42 U	0.42 U	0.38 U
Dibenzo(a,h)anthracene		53-70-3	0.33	0.33	0.56	1.1		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Indeno(1,2,3-cd)pyrene		193-39-5	0.5	0.5	5.6	11		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Total Carcinogenic PAHs								**0.023**	0	**0.188**	0	0	0	0	0	**0.147**	0	**0.084**	0	0	0
Non-Carcinogenic PAHs																					
2-Methylnaphthalene	mg/kg	91-57-6	NE	NE	NE	NE		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Acenaphthene		83-32-9	20	100	500	1000		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	**0.052 J**	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	**0.083 J**	0.38 U
Acenaphthylene		208-96-8	100	100	500	1000		**0.002 J**	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Anthracene		120-12-7	100	100	500	1000		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	**0.054 J**	0.43 U	0.39 U	0.42 U	**0.055 J**	0.38 U
Benzo(g,h,i)perylene		191-24-2	100	100	500	1000		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Fluoranthene		206-44-0	100	100	500	1000		**0.009 J**	0.4 U	**0.095 J**	0.39 U	0.39 U	0.39 U	**0.047 J**	0.33 U	**0.1 J**	0.43 U	**0.083 J**	**0.05 J**	**0.064 J**	0.38 U
Fluorene		86-73-7	30	100	500	1000		0.41 U	0.4 U	0.42 U	0.39 U	0.39 U	0.39 U	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	0.42 U	0.38 U
Naphthalene		91-20-3	12	100	500	1000		**0.002 J**	0.4 U	0.42 U	0.39 U	0.39 U	**0.18 J**	0.4 U	0.33 U	0.39 U	0.43 U	0.39 U	0.42 U	**0.049 J**	0.38 U
Phenanthrene		85-01-8	100	100	500	1000		0.41 U	**0.068 J**	**0.15 J**	0.39 U	0.39 U	**0.058 J**	**0.061 J**	0.33 U	**0.26 J**	0.43 U	**0.21 J**	**0.15 J**	**0.24 J**	0.38 U
Pyrene		129-00-0	100	100	500	1000		**0.023 J**	**0.065 J**	**0.14 J**	0.39 U	0.39 U	0.39 U	**0.083 J**	0.33 U	**0.18 J**	0.43 U	**0.13 J**	**0.078 J**	**0.088 J**	0.38 U
Total Non-Carcinogenic PAHs								**0.036**	**0.133**	**0.385**	0	0	**0.29**	**0.191**	0	**0.594**	0	**0.423**	**0.278**	**0.579**	0
Total PAHs								**0.059**	**0.133**	**0.573**	0	0	**0.29**	**0.191**	0	0.741	0	**0.507**	**0.278**	**0.579**	0
Other Semivolatile Organic Compounds	ug/lg																				
1,2-Dichlorobenzene		95-50-1	1100	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1-Methyl naphthalene		90-12-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		120-83-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		121-14-2	NA	NA	NA	NA		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		95-48-7	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		106-44-5	330	100000	500000	1000000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy- (Phenol)		108-95-2	330	100000	500000	1000000		NA	12000 U	12000 U	NA	NA	NA	12000 U	12000 U	12000 U	12000 U	12000 U	12000 U	NA	NA
Bis(2-ethylhexyl)phthalate		117-81-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		85-68-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		86-74-8	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		132-64-9	7000	59000	350000	1000000		NA	400 U	420 U	390 U	390 U	390 U	400 U	330 U	390 U	430 U	390 U	420 U	420 U	380 U
Di-n-butylphthalate		84-74-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		117-84-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		86-30-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (isopropyltoluene)		99-87-6	NE	NE	NE	NE															
Metals	mg/kg																				
Aluminum		7429-90-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony		7440-36-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic		7440-38-2	13	16	16	16		**1.1 B**	**0.48 B**	**1.6**	**0.39 B**	**0.86 B**	**0.51 B**	**0.5 B**	**0.94**	**0.7 B**	**0.82 B**	**0.7 B**	**1.1**	NA	NA
Barium		7440-39-3	350	400	400	10000		**1.1 B**	**4.5 B**	**5.9 B**	**1.1 B**	2.2 U	**1.4 B**	**3.3 B**	**3.2 B**	**1.3 B**	**2 B**	**3.7 B**	**2.1 B**	NA	NA
Beryllium		7440-41-7	7.2	72	590	2700		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium		7440-43-9	2.5	4.3	9.3	60		0.2 U	0.22 U	**0.4 B**	0.17 U	0.21 U	0.2 U	0.21 U	0.16 U	0.19 U	0.21 U	0.22 U	0.19 U	NA	NA
Calcium		7440-70-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium		7440-47-3	NE	NE	NE	NE		**1.8 B**	**3**	**4.3**	**1.4 B**	**2.1**	**1.2 B**	**1.1 B**	**3**	**1.8 B**	**1.4 B**	**2.4**	**1.3 B**	NA	NA
Cobalt		7440-48-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper		7440-50-8	50	270	270	10,000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron		7439-89-6	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead		7439-92-1	63	400	1000	3900		**0.85**	**1.5**	**4.3**	**0.48 B**	**0.77 B**	**0.59 B**	**0.71 B**	**0.93**	**0.76 B**	**0.72 B**	**0.71 B**	**0.59 B**	NA	NA
Magnesium		7439-95-4	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese		7439-96-5	1600	2000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury		7439-97-6	0.18	0.81	2.8	5.7		0.025 U	0.018 U	0.019 U	0.055 U	0.049 U	0.057 U	0.015 U	0.019 U	0.02 U	0.02 U	0.02 U	0.019 U	NA	NA
Nickel		7440-02-0	30	310	310	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium		7440-09-7	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium		7782-49-2	3.9	180	1500	6800		**0.92 B**	0.45 U	0.46 U	0.35 U	0.42 U	0.4 U	0.43 U	0.33 B	0.37 U	0.42 U	0.45 U	0.38 U	NA	NA
Silver		7440-22-4	2	180	1500	6800		0.2 U	0.34 U	0.34 U	0.26 U	0.32 U	0.3 U	0.32 U	0.24 U	0.28 U	0.32 U	0.34 U	0.29 U	NA	NA
Sodium		7440-23-5	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium		7440-28-0	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium		7440-62-2	NE	NE	NE	NE		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc		7440-66-6	109	10000	10000	10000		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	mg/kg																				
Cyanide, total		57-12-5	27	27	27	10,000		0.618 U	**0.13 B**	**0.16 B**	0.056 U	**0.68 B**	0.06 U	0.03 U	0.042 U	0.039 U	0.041 U	0.033 U	0.037 U	7 U	7 U

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED02-1	RPSED02-1	RPSED02-1	RPSED02-2	RPSED02-2	RPSED02-3	RPSED02-3	RPSED02-4	RPSED02-4
				Sample Name	RPSED02-1 (0.0-0)	RPSED02-1 (0.3-3)	RPSEDXX100902	RPSED02-2 (0-0.3)	RPSED02-2 (0.3-3)	RPSED02-3 (0-0.3)	RPSED02-3 (0.3-3)	RPSED02-4 (0-0.3)	RPSED02-4 (0.3-3)
				Start Depth	0	0.3	0.3	0	0.3	0	0.3	0	0.3
				End Depth	0.3	3	3 (Dup)	0.3	3	0.3	3	0.3	3
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**										
BTEX	mg/kg												
Benzene		NE	NE	0.006 U	0.006 U	0.006 U	0.007 U	0.006 U	0.006 U	0.007 U	0.006 U	0.006 U
Toluene		NE	NE	0.006 U	0.006 U	0.006 U	0.007 U	0.006 U	0.002 J	0.007 U	0.006 U	0.006 U
Ethyl benzene		NE	NE	0.006 U	0.006 U	0.006 U	0.007 U	0.006 U	0.006 U	0.007 U	0.006 U	0.006 U
Xylene (total)		NE	NE	0.006 U	0.006 U	0.006 U	0.007 U	0.006 U	0.006 U	0.007 U	0.006 U	0.006 U
Total BTEX		NE	NE	0	0	0	0	0	0.002	0	0	0
Other Volatile Organic Compounds	*ug/kg*												
1,1,1-Trichloroethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
1,1,2,2-Tetrachloroethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
1,1,2-Trichloroethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
1,1-Dichloroethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
1,1-Dichloroethene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
1,2-Dichloroethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
1,2-Dichloropropane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
2-Butanone		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
2-Hexanone		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
4-Methyl-2-pentanone		NE	NE	6 U	6 U	6 U	7 U	6 U	6 UJ	7 U	6 U	6 U
Acetone		NE	NE	6 U	6 U	6 U	12	15	50	21	6 U	6 J
Bromodichloromethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Bromoform		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Bromomethane		NE	NE	6 UJ	6 U	6 U	7 UJ	6 UJ	6 U	7 UJ	6 UJ	6 UJ
Carbon disulfide		NE	NE	6 U	6 U	6 U	2 J	2 J	6 U	2 J	6 U	6 U
Carbon tetrachloride		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Chlorobenzene		NE	NE	6 U	6 U	6 U	7 U	6 U	4 J	7 U	6 U	6 U
Chloroethane		NE	NE	6 UJ	6 U	6 U	7 UJ	6 UJ	6 U	7 UJ	6 UJ	6 UJ
Chloroform		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Chloromethane		NE	NE	6 UJ	6 U	6 U	7 UJ	6 UJ	6 U	7 UJ	6 UJ	6 UJ
Dibromochloromethane		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Methylene chloride		NE	NE	3 JB	2 JB	4 JB	7 U	3 JB	5 JB	3 JB	2 JB	2 JB
Styrene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Tetrachloroethene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Trichloroethene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Vinyl chloride		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
cis-1,2-Dichloroethene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
cis-1,3-Dichloropropene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
trans-1,2-Dichloroethene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
trans-1,3-Dichloropropene		NE	NE	6 U	6 U	6 U	7 U	6 U	6 U	7 U	6 U	6 U
Semivolatile Organic Compounds	*mg/kg*												
Carcinogenic PAHs													
Benzo(a)anthracene		0.26	1.6	1.6 J	0.39 U	0.39 U	0.92	0.52	0.49 J	2.1 J	0.18 J	0.044 J
Benzo(a)pyrene		0.43	1.6	1.2 J	0.39 U	0.39 U	0.61	0.43	0.37 J	1.7 J	0.18 J	0.4 U
Benzo(b)fluoranthene		NE	NE	0.96 J	0.39 U	0.39 U	0.75	0.39 J	0.44 J	1.7 J	0.14 J	0.4 U
Benzo(k)fluoranthene		NE	NE	0.26 J	0.39 U	0.39 U	0.24 J	0.15 J	2 U	0.66 J	0.075 J	0.4 U
Chrysene		0.38	2.8	1.6 J	0.39 U	0.39 U	1	0.53	0.57 J	2.2 J	0.18 J	0.4 U
Dibenzo(a,h)anthracene		0.06	0.26	2 U	0.39 U	0.39 U	0.08 J	0.057 J	2 U	2.2 U	0.38 UJ	0.4 U
Indeno(1,2,3-cd)pyrene		NE	NE	0.45 J	0.39 U	0.39 U	0.37 J	0.19 J	0.23 J	0.78 J	0.38 UJ	0.4 U
Total Carcinogenic PAHs		NE	NE	6.07	0	0	3.97	2.27	2.1	9.14	0.755	0.04
Non-Carcinogenic PAHs													
2-Methylnaphthalene		0.07	0.67	2 U	0.39 U	0.39 U	0.059 J	0.41 U	2 U	2.2 U	0.38 UJ	0.4 U
Acenaphthene		0.02	0.5	2 U	0.39 U	0.39 U	0.49 U	0.41 U	2 U	2.2 U	0.38 UJ	0.4 U
Acenaphthylene		0.04	0.64	0.42 J	0.39 U	0.39 U	0.36 J	0.18 J	0.25 J	0.8 J	0.045 J	0.4 U
Anthracene		0.09	1.1	0.44 J	0.39 U	0.39 U	0.28 J	0.16 J	2 U	0.65 J	0.059 J	0.4 U
Benzo(g,h,i)perylene		NE	NE	0.54 J	0.39 U	0.39 U	0.41 J	0.22 J	0.26 J	0.86 J	0.38 UJ	0.4 U
Fluoranthene		0.6	5.1	1.7 J	0.39 U	0.39 U	1.3	0.68	0.62 J	3.2	0.2 J	0.042 J
Fluorene		0.02	0.54	2 U	0.39 U	0.39 U	0.078 J	0.052 J	2 U	0.26 J	0.38 UJ	0.4 U
Naphthalene		0.16	2.1	2 U	0.39 U	0.39 U	0.081 J	0.41 U	2 U	0.28 J	0.38 UJ	0.4 U
Phenanthrene		0.24	1.5	0.91 J	0.39 U	0.39 U	0.73	0.37 J	0.34 J	1.8 J	0.14 J	0.4 U
Pyrene		0.67	2.6	4	0.39 U	0.39 U	2.1	1.5	1.1 J	5.2	0.67 J	0.11 J
Total Non-Carcinogenic PAHs		NE	NE	8.01	0	0	5.40	3.16	2.57	13.05	1.11	0.15
Total PAHs		4.02	44.8	14.08	0	0	9.37	5.43	4.67	22.19	1.87	0.20

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Analyte	Units	New York Cleanup Objective ERL	New York Cleanup Objective ERM	Location Name / Sample Name / Start Depth / End Depth / Depth Unit / Sample Date								
				RPSED02-1 RPSED02-1 (0.0-0) 0 0.3 ft 10/09/2002	RPSED02-1 RPSED02-1 (0.3-3) 0.3 3 ft 10/09/2002	RPSED02-1 RPSEDXX100902 0.3 3 (Dup) ft 10/09/2002	RPSED02-2 RPSED02-2 (0-0.3) 0 0.3 ft 10/09/2002	RPSED02-2 RPSED02-2 (0.3-3) 0.3 3 ft 10/09/2002	RPSED02-3 RPSED02-3 (0-0.3) 0 0.3 ft 10/09/2002	RPSED02-3 RPSED02-3 (0.3-3) 0.3 3 ft 10/09/2002	RPSED02-4 RPSED02-4 (0-0.3) 0 0.3 ft 10/09/2002	RPSED02-4 RPSED02-4 (0.3-3) 0.3 3 ft 10/09/2002
Other Semivolatile Organic Compounds	*ug/kg*											
1,2,4-Trichlorobenzene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
1,2-Dichlorobenzene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
1,3-Dichlorobenzene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
1,4-Dichlorobenzene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2,4,5-Trichlorophenol		NE	NE	4000 U	790 U	790 U	1000 U	830 U	4000 U	4500 U	780 UJ	820 U
2,4,6-Trichlorophenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2,4-Dichlorophenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2,4-Dimethylphenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2,4-Dinitrophenol		NE	NE	4000 U	790 U	790 U	1000 U	830 U	4000 U	4500 U	780 UJ	820 U
2,4-Dinitrotoluene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2,6-Dinitrotoluene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2-Chloronaphthalene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2-Chlorophenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2-Methylphenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
2-Nitroaniline		NE	NE	4000 U	790 U	790 U	1000 U	830 U	4000 U	4500 U	780 UJ	820 U
2-Nitrophenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
3,3-Dichlorobenzidine		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
3-Nitroaniline		NE	NE	4000 UJ	790 U	790 U	1000 UJ	830 U	4000 UJ	4500 UJ	780 UJ	820 U
4,6-Dinitro-2-methylphenol		NE	NE	4000 U	790 U	790 U	1000 U	830 U	4000 U	4500 U	780 UJ	820 U
4-Chloro-3-methylphenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
4-Chloroaniline		NE	NE	2000 U	390 U	390 U	490 UJ	410 U	2000 UJ	2200 UJ	380 UJ	400 U
4-Methylphenol		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
4-Nitroaniline		NE	NE	4000 UJ	790 U	790 U	1000 UJ	830 U	4000 UJ	4500 UJ	780 UJ	820 U
4-Nitrophenol		NE	NE	4000 UJ	790 U	790 U	1000 UJ	830 U	4000 UJ	4500 UJ	780 UJ	820 U
4-bromophenyl-phenylether		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
4-chlorophenyl-phenylether		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Benzene, hydroxy-		NE	NE	2000 U	390 U	470	98 J	64 J	2000 U	2200 U	380 UJ	400 U
Bis(2-chloro-1-methylethyl) ether		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Bis(2-chloroethoxy)methane		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Bis(2-chloroethyl)ether		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Bis(2-ethylhexyl)phthalate		NE	NE	2000 U	390 U	390 U	250 J	76 J	2000 U	2200 U	81 J	400 U
Butylbenzylphthalate		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Carbazole		NE	NE	2000 UJ	390 U	390 U	490 UJ	410 U	2000 UJ	2200 UJ	380 UJ	400 U
Di-n-butylphthalate		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Di-n-octylphthalate		NE	NE	2000 U	390 U	390 U	430 J	410 U	2000 U	2200 U	1200 J	180 J
Dibenzofuran		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Diethylphthalate		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Dimethylphthalate		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Hexachlorobenzene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Hexachlorobutadiene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Hexachlorocyclopentadiene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Hexachloroethane		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Isophorone		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
N-Nitroso-di-n-propylamine		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
N-Nitrosodiphenylamine (1)		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Nitrobenzene		NE	NE	2000 U	390 U	390 U	490 U	410 U	2000 U	2200 U	380 UJ	400 U
Pentachlorophenol		NE	NE	4000 U	790 U	790 U	1000 U	830 U	4000 U	4500 U	780 UJ	820 U
Total Cyanide	*mg/kg*											
Cyanide		NE	NE	0.17 U	0.16 U	0.15 U	0.22 UJ	0.18 UJ	0.17 UJ	0.18 UJ	0.17 U	0.17 U
Total Organic Carbon	*%*											
TOC		NE	NE	0.3	0.1	0.2	2.6	3.3	1.2	3.5	0.3	0.2

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED02-5	RPSED02-5	RPSED02-6	RPSED02-6	RPSED02-6	RPSED02-6	RPSED02-7	RPSED02-7	RPSED02-8
				Sample Name	RPSED02-5 (0.0-0)	RPSED02-5 (0.3-3)	RPSED02-6 (0-0.3)	RPSED02-6 (0.3-1)	RPSED02-6 (1.9-2)	RPSED02-6 (2.4-4)	RPSED02-7(0.0-0)	RPSED02-7 (0.3-3)	RPSED02-8 (0-0.3)
				Start Depth	0	0.3	0	0.3	1.9	2.4	0	0.3	0
				End Depth	0.3	3	0.3	1.9	2.4	4.4	0.3	3	0.3
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**										
BTEX	mg/kg												
Benzene		NE	NE	0.006 U	0.005 U	0.007 UJ	0.002 J	0.052 U	0.006 U	0.006 U	0.006 U	0.006 U	
Toluene		NE	NE	0.006 U	0.005 U	0.007 UJ	0.006 U	0.052 U	0.006 U	0.006 U	0.006 U	0.006 U	
Ethyl benzene		NE	NE	0.006 U	0.005 U	0.011 J	0.16	1.2	0.003 J	0.006 U	0.006 U	0.006 U	
Xylene (total)		NE	NE	0.006 U	0.005 U	0.007 UJ	0.002 J	0.073	0.006 U	0.006 U	0.006 U	0.006 U	
Total BTEX		NE	NE	0	0	0.011	0.16	1.27	0.003	0	0	0	
Other Volatile Organic Compounds	*ug/kg*												
1,1,1-Trichloroethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
1,1,2,2-Tetrachloroethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
1,1,2-Trichloroethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
1,1-Dichloroethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
1,1-Dichloroethene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
1,2-Dichloroethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
1,2-Dichloropropane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
2-Butanone		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
2-Hexanone		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
4-Methyl-2-pentanone		NE	NE	6 UJ	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Acetone		NE	NE	5 J	9	44 J	15	52 U	6 J	6 U	8	6 U	
Bromodichloromethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Bromoform		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Bromomethane		NE	NE	6 U	5 UJ	7 UJ	6 U	52 U	6 UJ	6 JU	6 UJ	6 UJ	
Carbon disulfide		NE	NE	6 U	5 U	7 UJ	2 J	52 U	6 U	6 U	1 J	6 U	
Carbon tetrachloride		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Chlorobenzene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Chloroethane		NE	NE	6 U	5 UJ	7 UJ	6 U	52 U	6 UJ	6 JU	6 UJ	6 UJ	
Chloroform		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Chloromethane		NE	NE	6 U	5 UJ	7 UJ	6 U	52 U	6 UJ	6 JU	6 UJ	6 UJ	
Dibromochloromethane		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Methylene chloride		NE	NE	3 JB	4 JB	3 JJB	4 J	36 J	3 JB	2 JB	3 JB	3 JB	
Styrene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Tetrachloroethene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Trichloroethene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Vinyl chloride		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
cis-1,2-Dichloroethene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
cis-1,3-Dichloropropene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
trans-1,2-Dichloroethene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
trans-1,3-Dichloropropene		NE	NE	6 U	5 U	7 UJ	6 U	52 U	6 U	6 U	6 U	6 U	
Semivolatile Organic Compounds	*mg/kg*												
Carcinogenic PAHs													
Benzo(a)anthracene		0.26	1.6	0.34 J	0.1 J	1.8 J	9.2	29	0.08 J	0.4 JU	0.2 J	0.09 J	
Benzo(a)pyrene		0.43	1.6	0.27 J	0.11 J	1.1 J	7.3	24	0.041 J	0.4 JU	1.9 J	0.073 J	
Benzo(b)fluoranthene		NE	NE	0.21 J	0.1 J	1.2 J	5.8	18	0.39 U	0.4 JU	1.6 J	0.065 J	
Benzo(k)fluoranthene		NE	NE	0.07 J	0.04 J	0.44 J	2.1 J	8.5	0.39 U	0.4 JU	0.68 J	0.39 U	
Chrysene		0.38	2.8	0.33 J	0.11 J	1.8 J	8.9	30	0.069 J	0.4 JU	0.2 J	0.077 J	
Dibenzo(a,h)anthracene		0.06	0.26	0.41 U	0.38 UJ	2.3 U	0.65 J	2.8 J	0.39 U	0.4 JU	0.17 J	0.39 U	
Indeno(1,2,3-cd)pyrene		NE	NE	0.096 J	0.38 UJ	0.61 J	2.7	8.3	0.39 U	0.4 JU	0.46 J	0.39 U	
Total Carcinogenic PAHs		NE	NE	1.32	0.46	6.95	36.65	120.6	0.19	0	5.3	0.31	
Non-Carcinogenic PAHs													
2-Methylnaphthalene		0.07	0.67	0.41 U	0.38 UJ	2.3 U	0.44 J	1.8 J	0.39 U	0.4 JU	0.092 J	0.39 U	
Acenaphthene		0.02	0.5	0.41 U	0.38 UJ	1.6 J	8.8	53	0.33 J	0.4 JU	0.4 UJ	0.39 U	
Acenaphthylene		0.04	0.64	0.11 J	0.045 J	0.63 J	3.4	11	0.045 J	0.4 JU	0.39 J	0.39 U	
Anthracene		0.09	1.1	0.12 J	0.38 UJ	0.6 J	3.1	13	0.093 J	0.4 JU	0.5 J	0.39 U	
Benzo(g,h,i)perylene		NE	NE	0.12 J	0.38 UJ	0.63 J	3	8.6	0.39 U	0.4 JU	0.54 J	0.39 U	
Fluoranthene		0.6	5.1	0.41	0.11 J	2.3	12	36	0.15 J	0.4 JU	1.8 J	0.087 J	
Fluorene		0.02	0.54	0.41 U	0.38 UJ	2.3 U	0.81 J	2.7 J	0.39 U	0.4 JU	0.11 J	0.39 U	
Naphthalene		0.16	2.1	0.41 U	0.38 UJ	2.3 U	1.7 J	7.1	0.39 U	0.4 JU	0.12 J	0.39 U	
Phenanthrene		0.24	1.5	0.21 J	0.056 J	1.2 J	4.1	14	0.4	0.4 JU	0.82 J	0.048 J	
Pyrene		0.67	2.6	0.82	0.34 J	4.2	23	54	0.26 J	0.058 J	6.5 JE	0.2 J	
Total Non-Carcinogenic PAHs		NE	NE	1.79	0.55	11.16	60.35	201.2	1.28	0.06	10.87	0.34	
Total PAHs		4.02	44.8	3.11	1.01	18.11	97	321.8	1.47	0.06	16.17	0.64	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED02-5	RPSED02-5	RPSED02-6	RPSED02-6	RPSED02-6	RPSED02-6	RPSED02-7	RPSED02-7	RPSED02-8
				Sample Name	RPSED02-5 (0.0-0)	RPSED02-5 (0.3-3)	RPSED02-6 (0-0.3)	RPSED02-6 (0.3-1)	RPSED02-6 (1.9-2)	RPSED02-6 (2.4-4)	RPSED02-7(0.0-0)	RPSED02-7 (0.3-3)	RPSED02-8 (0-0.3)
				Start Depth	0	0.3	0	0.3	1.9	2.4	0	0.3	0
				End Depth	0.3	3	0.3	1.9	2.4	4.4	0.3	3	0.3
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**										
Other Semivolatile Organic Compounds	*ug/kg*												
1,2,4-Trichlorobenzene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
1,2-Dichlorobenzene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
1,3-Dichlorobenzene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
1,4-Dichlorobenzene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2,4,5-Trichlorophenol		NE	NE	830 U	760 UJ	4600 U	4300 U	12000 U	780 U	820 JU	800 UJ	790 U	
2,4,6-Trichlorophenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2,4-Dichlorophenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2,4-Dimethylphenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2,4-Dinitrophenol		NE	NE	830 U	760 UJ	4600 U	4300 U	12000 U	780 U	820 JU	800 UJ	790 U	
2,4-Dinitrotoluene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2,6-Dinitrotoluene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2-Chloronaphthalene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2-Chlorophenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2-Methylphenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
2-Nitroaniline		NE	NE	830 U	760 UJ	4600 U	4300 U	12000 U	780 U	820 JU	800 UJ	790 U	
2-Nitrophenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
3,3-Dichlorobenzidine		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 UJ	390 U	400 JU	400 UJ	390 U	
3-Nitroaniline		NE	NE	830 UJ	760 UJ	4600 UJ	4300 UJ	12000 UJ	780 U	820 JU	800 UJ	790 U	
4,6-Dinitro-2-methylphenol		NE	NE	830 U	760 UJ	4600 U	4300 U	12000 U	780 U	820 JU	800 UJ	790 U	
4-Chloro-3-methylphenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
4-Chloroaniline		NE	NE	410 UJ	380 UJ	2300 UJ	2100 UJ	6100 UJ	390 U	400 JU	400 UJ	390 U	
4-Methylphenol		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
4-Nitroaniline		NE	NE	830 UJ	760 UJ	4600 UJ	4300 UJ	12000 UJ	780 U	820 JU	800 UJ	790 U	
4-Nitrophenol		NE	NE	830 UJ	760 UJ	4600 UJ	4300 UJ	12000 U	780 U	820 JU	800 UJ	790 U	
4-bromophenyl-phenylether		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
4-chlorophenyl-phenylether		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Benzene, hydroxy-		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	78 J	400 UJ	75 J	
Bis(2-chloro-1-methylethyl) ether		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Bis(2-chloroethoxy)methane		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Bis(2-chloroethyl)ether		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Bis(2-ethylhexyl)phthalate		NE	NE	64 J	380 UJ	420 J	2100 U	6100 U	390 U	57 J	45 J	390 U	
Butylbenzylphthalate		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Carbazole		NE	NE	410 UJ	380 UJ	2300 UJ	550 J	2600 J	390 U	400 JU	400 UJ	390 U	
Di-n-butylphthalate		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Di-n-octylphthalate		NE	NE	410 U	380 UJ	330 J	2100 U	6100 U	390 U	400 JU	400 UJ	180 J	
Dibenzofuran		NE	NE	410 U	380 UJ	2300 U	2100 U	980 J	390 U	400 JU	400 UJ	390 U	
Diethylphthalate		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Dimethylphthalate		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Hexachlorobenzene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Hexachlorobutadiene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Hexachlorocyclopentadiene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Hexachloroethane		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Isophorone		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
N-Nitroso-di-n-propylamine		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 UJ	390 U	400 JU	400 UJ	390 U	
N-Nitrosodiphenylamine (1)		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Nitrobenzene		NE	NE	410 U	380 UJ	2300 U	2100 U	6100 U	390 U	400 JU	400 UJ	390 U	
Pentachlorophenol		NE	NE	830 U	760 UJ	4600 U	4300 U	12000 U	780 U	820 JU	800 UJ	790 U	
Total Cyanide	*mg/kg*												
Cyanide		NE	NE	0.18 UJ	NA	0.21 UJ	0.19 UJ	0.16 UJ	NA	0.16 JU	NA	NA	
Total Organic Carbon	*%*												
TOC		NE	NE	0.6	0.1	3.4	1.5	0.2	NA	0.03	0.3	0.3	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED02-8	RPSED02-9	RPSED02-9	RPSEDBG-A	RPSEDBG-B	RPSEDBG-C	RPSEDBG-D	RPSEDBG-E	RPSEDBG-F	RPSEDBG-G	RPSEDBG-H	RPSED03-01
				Sample Name	RPSED02-8 (0.3-3)	RPSED02-9 (0-0.3)	RPSED02-9 (0.3-3)	RPSEDBG-A	RPSEDBG-B	RPSEDBG-C	RPSEDBG-D	RPSEDBG-E	RPSEDBG-F	RPSEDBG-G	RPSEDBG-H	RPSED03-01(1-3)
				Start Depth	0.3	0	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
				End Depth	3	0.3	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	11/17/2003
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**													
BTEX	mg/kg															
Benzene		NE	NE	0.006 U	0.007 U	0.006 U	0.016 UJ	0.006 U	0.007 U	0.007 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA
Toluene		NE	NE	0.006 U	0.007 U	0.006 U	0.016 UJ	0.006 U	0.007 U	0.007 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA
Ethyl benzene		NE	NE	0.006 U	0.007 U	0.006 U	0.016 UJ	0.006 U	0.007 U	0.007 U	0.006 U	0.008	0.006 U	0.006 U	0.006 U	NA
Xylene (total)		NE	NE	0.006 U	0.007 U	0.006 U	0.016 UJ	0.006 U	0.007 U	0.007 U	0.006 U	0.006 U	0.006 U	0.006 U	0.006 U	NA
Total BTEX		NE	NE	0	0	0	0	0	0	0	0	0.008	0	0	0	NA
Other Volatile Organic Compounds	*ug/kg*															NA
1,1,1-Trichloroethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
1,1,2,2-Tetrachloroethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
1,1,2-Trichloroethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
1,1-Dichloroethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
1,1-Dichloroethene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
1,2-Dichloroethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
1,2-Dichloropropane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
2-Butanone		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
2-Hexanone		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
4-Methyl-2-pentanone		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Acetone		NE	NE	6 U	22	25	84 J	6 U	7 U	52	6 U	6 U	8	6 U	6 U	NA
Bromodichloromethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Bromoform		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Bromomethane		NE	NE	6 U	7 UJ	6 UJ	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Carbon disulfide		NE	NE	6 U	2 J	2 J	16 UJ	6 U	7 U	3 J	6 U	6 U	6 U	6 U	6 U	NA
Carbon tetrachloride		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Chlorobenzene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Chloroethane		NE	NE	6 U	7 UJ	6 UJ	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Chloroform		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Chloromethane		NE	NE	6 U	7 UJ	6 UJ	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Dibromochloromethane		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Methylene chloride		NE	NE	3 JB	3 JB	3 JB	11 JB	2 JB	4 JB	3 JB	4 J	2 JB	2 J	3 JB	3 JB	NA
Styrene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Tetrachloroethene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Trichloroethene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Vinyl chloride		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
cis-1,2-Dichloroethene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
cis-1,3-Dichloropropene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
trans-1,2-Dichloroethene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
trans-1,3-Dichloropropene		NE	NE	6 U	7 U	6 U	16 UJ	6 U	7 U	7 U	6 U	6 U	6 U	6 U	6 U	NA
Semivolatile Organic Compounds	*mg/kg*															
Carcinogenic PAHs																
Benzo(a)anthracene		0.26	1.6	0.4 UJ	1.2 J	1.9 J	0.51 J	0.42 U	0.1 J	0.63	0.41 U	0.4 U	0.3 J	0.22 J	15	
Benzo(a)pyrene		0.43	1.6	0.4 UJ	1 J	1.5 J	0.41 J	0.42 U	0.084 J	0.52	0.41 U	0.4 U	0.27 J	0.19 J	11	
Benzo(b)fluoranthene		NE	NE	0.4 UJ	0.9 J	1.4 J	0.45 J	0.42 U	0.065 J	0.45 J	0.41 U	0.4 U	0.22 J	0.2 J	8.7	
Benzo(k)fluoranthene		NE	NE	0.4 UJ	0.26 J	0.61 J	0.17 J	0.42 U	0.46 U	0.19 J	0.41 U	0.4 U	0.086 J	0.078 J	2.6 J	
Chrysene		0.38	2.8	0.4 UJ	1.3 J	1.8 J	0.52 J	0.42 U	0.1 J	0.65	0.41 U	0.4 U	0.36 J	0.22 J	14	
Dibenzo(a,h)anthracene		0.06	0.26	0.4 UJ	2.3 U	2.1 U	1.1 U	0.42 U	0.46 U	0.071 J	0.41 U	0.4 U	0.42 U	0.4 U	1.5 J	
Indeno(1,2,3-cd)pyrene		NE	NE	0.4 UJ	0.47 J	0.69 J	0.19 J	0.42 U	0.46 U	0.28 J	0.41 U	0.4 U	0.13 J	0.11 J	3.9 J	
Total Carcinogenic PAHs		NE	NE	0	5.13	7.9	2.25	0	0.35	2.79	0	0	1.37	1.018	56.7	
Non-Carcinogenic PAHs																
2-Methylnaphthalene		0.07	0.67	0.4 UJ	2.3 U	2.1 U	1.1 U	0.42 U	0.46 U	0.48 U	0.41 U	0.4 U	0.42 U	0.4 U	2.5 J	
Acenaphthene		0.02	0.5	0.4 UJ	2.3 U	2.1 U	1.1 U	0.42 U	0.46 U	0.48 U	0.41 U	0.4 U	0.42 U	0.4 U	37 J	
Acenaphthylene		0.04	0.64	0.4 UJ	0.39 J	0.43 J	0.14 J	0.42 U	0.46 U	0.16 J	0.41 U	0.4 U	0.086 J	0.048 J	22	
Anthracene		0.09	1.1	0.4 UJ	0.37 J	0.59 J	0.83 J	0.42 U	0.46 U	0.66	0.41 U	0.4 U	0.08 J	0.059 J	25	
Benzo(g,h,i)perylene		NE	NE	0.4 UJ	0.47 J	0.74 J	0.21 J	0.42 U	0.46 U	0.29 J	0.41 U	0.4 U	0.14 J	0.12 J	5.1 J	
Fluoranthene		0.6	5.1	0.4 UJ	1.6 J	2.8	0.77 J	0.42 U	0.1 J	0.77	0.41 U	0.4 U	0.42 J	0.31 J	25	
Fluorene		0.02	0.54	0.4 UJ	2.3 U	0.24 J	0.24 J	0.42 U	0.46 U	0.12 J	0.41 U	0.4 U	0.42 U	0.4 U	24	
Naphthalene		0.16	2.1	0.4 UJ	2.3 U	2.1 U	1.1 U	0.42 U	0.46 U	0.078 J	0.41 U	0.4 U	0.42 U	0.4 U	66	
Phenanthrene		0.24	1.5	0.4 UJ	0.58 J	1.7 J	0.69 J	0.42 U	0.46 U	0.56	0.41 U	0.4 U	0.27 J	0.16 J	100	
Pyrene		0.67	2.6	0.4 UJ	3.2	5	1 J	0.42 U	0.23 J	1.4	0.41 U	0.4 U	0.76	0.43	46	
Total Non-Carcinogenic PAHs		NE	NE	0.00	6.61	11.5	3.88	0.00	0.33	4.04	0	0.00	1.76	1.13	352.6	
Total PAHs		4.02	44.8	0.00	11.74	19.4	6.13	0.00	0.68	6.83	0	0.00	3.12	2.15	409.3	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED02-8	RPSED02-9	RPSED02-9	RPSEDBG-A	RPSEDBG-B	RPSEDBG-C	RPSEDBG-D	RPSEDBG-E	RPSEDBG-F	RPSEDBG-G	RPSEDBG-H	RPSED03-01
				Sample Name	RPSED02-8 (0.3-3)	RPSED02-9 (0-0.3)	RPSED02-9 (0.3-3)	RPSEDBG-A	RPSEDBG-B	RPSEDBG-C	RPSEDBG-D	RPSEDBG-E	RPSEDBG-F	RPSEDBG-G	RPSEDBG-H	RPSED03-01(1-3)
				Start Depth	0.3	0	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1
				End Depth	3	0.3	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	10/09/2002	11/17/2003
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**													
Other Semivolatile Organic Compounds	*ug/kg*															
1,2,4-Trichlorobenzene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
1,2-Dichlorobenzene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
1,3-Dichlorobenzene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
1,4-Dichlorobenzene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2,4,5-Trichlorophenol		NE	NE	810 U	4800 U	4300 U	2300 U	850 U	920 U	970 U	840 U	820 U	860 U	810 U	NA	
2,4,6-Trichlorophenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2,4-Dichlorophenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2,4-Dimethylphenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2,4-Dinitrophenol		NE	NE	810 U	4800 U	4300 U	2300 U	850 U	920 U	970 U	840 U	820 U	860 U	810 U	NA	
2,4-Dinitrotoluene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2,6-Dinitrotoluene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2-Chloronaphthalene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2-Chlorophenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2-Methylphenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
2-Nitroaniline		NE	NE	810 UJ	4800 U	4300 U	2300 U	850 U	920 U	970 U	840 U	820 U	860 U	810 U	NA	
2-Nitrophenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
3,3-Dichlorobenzidine		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
3-Nitroaniline		NE	NE	810 UJ	4800 UJ	4300 U	2300 UJ	850 UJ	920 U	970 U	840 U	820 U	860 U	810 U	NA	
4,6-Dinitro-2-methylphenol		NE	NE	810 U	4800 U	4300 U	2300 U	850 U	920 U	970 U	840 U	820 U	860 U	810 U	NA	
4-Chloro-3-methylphenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
4-Chloroaniline		NE	NE	400 UJ	2300 UJ	2100 U	1100 UJ	420 UJ	460 U	480 U	410 U	400 U	420 U	400 U	NA	
4-Methylphenol		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
4-Nitroaniline		NE	NE	810 UJ	4800 UJ	4300 U	2300 UJ	850 UJ	920 U	970 U	840 U	820 U	860 U	810 U	NA	
4-Nitrophenol		NE	NE	810 U	4800 UJ	4300 U	2300 UJ	850 UJ	920 U	970 U	840 U	820 U	860 U	810 U	NA	
4-bromophenyl-phenylether		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
4-chlorophenyl-phenylether		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Benzene, hydroxy-		NE	NE	400 U	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Bis(2-chloro-1-methylethyl) ether		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Bis(2-chloroethoxy)methane		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Bis(2-chloroethyl)ether		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Bis(2-ethylhexyl)phthalate		NE	NE	400 UJ	240 J	2100 U	710 J	47 J	54 J	240 J	410 U	44 J	330 J	400 U	NA	
Butylbenzylphthalate		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	150 J	410 U	400 U	420 U	400 U	NA	
Carbazole		NE	NE	400 UJ	2300 UJ	2100 U	190 J	420 UJ	460 U	88 J	410 U	400 U	420 U	400 U	1.3 J	
Di-n-butylphthalate		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Di-n-octylphthalate		NE	NE	400 UJ	400 J	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Dibenzofuran		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	3.2 J	
Diethylphthalate		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Dimethylphthalate		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Hexachlorobenzene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Hexachlorobutadiene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Hexachlorocyclopentadiene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Hexachloroethane		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Isophorone		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
N-Nitroso-di-n-propylamine		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
N-Nitrosodiphenylamine (1)		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Nitrobenzene		NE	NE	400 UJ	2300 U	2100 U	1100 U	420 U	460 U	480 U	410 U	400 U	420 U	400 U	NA	
Pentachlorophenol		NE	NE	810 U	4800 U	4300 U	2300 U	850 U	920 U	970 U	840 U	820 U	860 U	810 U	NA	
Total Cyanide	*mg/kg*															
Cyanide		NE	NE	0.16 UJ	0.35 JB	0.18 UJ	0.49 U	0.18 U	0.17 U	0.21 U	0.16 U	0.18 U	0.20 U	0.17 U	NA	
Total Organic Carbon	*%*															
TOC		NE	NE	0.1	1.6	1.4	18	0.8	0.9	5.6	0.1 U	0.6	1.3	0.5	18000	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSEDXX-XX	RPSED03-01	RPSED03-02	RPSED03-02	RPSED03-03	RPSED03-03	RPSED03-04	RPSED03-04	RPSED03-05
				Sample Name	RPSED03-01(1-3) DUP	RPSED03-01(5-6)	RPSED03-02(0-0.25)	RPSED03-02(4-5)	RPSED03-03(0-0.25)	RPSED03-03(6-7)	RPSED03-04(0-0.25)	RPSED03-04(7-8)	RPSED03-05(0-0.25)
				Start Depth	1	5	0	4	0	6	0	7	0
				End Depth	3	6	0.25	5	0.25	7	0.25	8	0.25
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**										
BTEX	mg/kg												
Benzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethyl benzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Xylene (total)		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total BTEX		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Other Volatile Organic Compounds	*ug/kg*			NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,1-Trichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2,2-Tetrachloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1,2-Trichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,1-Dichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichloropropane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Hexanone		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methyl-2-pentanone		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromodichloromethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromoform		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bromomethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon disulfide		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbon tetrachloride		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloromethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibromochloromethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methylene chloride		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tetrachloroethene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vinyl chloride		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,2-Dichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,2-Dichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
trans-1,3-Dichloropropene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semivolatile Organic Compounds	*mg/kg*												
Carcinogenic PAHs													
Benzo(a)anthracene		0.26	1.6	0.51	0.39 U	2 J	0.37 U	5.3	0.37 U	0.59 J	0.38 U	0.78 J	
Benzo(a)pyrene		0.43	1.6	0.4	0.39 U	1.4 J	0.37 UJ	4.1	0.37 U	0.44 J	0.38 U	0.64 J	
Benzo(b)fluoranthene		NE	NE	0.37 J	0.39 U	1.7 J	0.37 UJ	2.6	0.37 U	0.33 J	0.38 U	0.71 J	
Benzo(k)fluoranthene		NE	NE	0.12 J	0.39 U	0.58 J	0.37 UJ	1.3 J	0.37 U	2 U	0.38 U	0.33 J	
Chrysene		0.38	2.8	0.5	0.39 U	2 J	0.37 U	5.1	0.37 U	0.58 J	0.38 U	0.92 J	
Dibenzo(a,h)anthracene		0.06	0.26	0.06 J	0.39 U	0.32 J	0.37 U	0.57 J	0.37 U	2 U	0.38 U	2.2 U	
Indeno(1,2,3-cd)pyrene		NE	NE	0.16 J	0.39 U	0.74 J	0.37 U	1.4 J	0.37 U	2 U	0.38 U	2.2 U	
Total Carcinogenic PAHs		NE	NE	2.12	0	8.74	0	20.37	0	1.94	0	3.38	
Non-Carcinogenic PAHs													
2-Methylnaphthalene		0.07	0.67	0.4 U	0.39 U	2.1 U	0.37 U	2 U	0.37 U	2 U	0.38 U	2.2 U	
Acenaphthene		0.02	0.5	0.4 U	0.39 U	2.1 U	0.37 U	0.24 J	0.37 U	2 U	0.38 U	1.1 J	
Acenaphthylene		0.04	0.64	0.11 J	0.39 U	0.45 J	0.37 U	1.2 J	0.37 U	2 U	0.38 U	0.24 J	
Anthracene		0.09	1.1	0.14 J	0.39 U	0.55 J	0.37 UJ	2.8	0.37 U	0.32 J	0.38 U	0.63 J	
Benzo(g,h,i)perylene		NE	NE	0.21 J	0.39 U	0.96 J	0.37 U	1.8 J	0.37 U	0.22 J	0.38 U	0.42 J	
Fluoranthene		0.6	5.1	0.57	0.39 U	2.2	0.37 UJ	7.1	0.37 U	0.67 J	0.38 U	1.1 J	
Fluorene		0.02	0.54	0.4 U	0.39 U	2.1 U	0.37 UJ	0.59 J	0.37 U	2 U	0.38 U	0.45 J	
Naphthalene		0.16	2.1	0.4 U	0.39 U	2.1 U	0.37 U	2 U	0.37 U	2 U	0.38 U	1.1 J	
Phenanthrene		0.24	1.5	0.22 J	0.39 U	1 J	0.37 UJ	4.9	0.37 U	0.7 J	0.38 U	1.5 J	
Pyrene		0.67	2.6	1.6 J	0.04 J	5.4	0.37 U	15	0.37 U	1.5 J	0.38 U	1.9 J	
Total Non-Carcinogenic PAHs		NE	NE	2.85	0.04	10.56	0	33.63	0	3.41	0	8.44	
Total PAHs		4.02	44.8	4.97	0.04	19.3	0	54	0	5.35	0	11.82	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSEDXX-XX	RPSED03-01	RPSED03-02	RPSED03-02	RPSED03-03	RPSED03-03	RPSED03-04	RPSED03-04	RPSED03-05
				Sample Name	RPSED03-01(1-3) DUP	RPSED03-01(5-6)	RPSED03-02(0-0.25)	RPSED03-02(4-5)	RPSED03-03(0-0.25)	RPSED03-03(6-7)	RPSED03-04(0-0.25)	RPSED03-04(7-8)	RPSED03-05(0-0.25)
				Start Depth	1	5	0	4	0	6	0	7	0
				End Depth	3	6	0.25	5	0.25	7	0.25	8	0.25
				Depth Unit	ft	ft	ft	ft	ft	ft	ft	ft	ft
				Sample Date	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**										
Other Semivolatile Organic Compounds	*ug/kg*												
1,2,4-Trichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,4-Dichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,5-Trichlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4,6-Trichlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dichlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dimethylphenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2,6-Dinitrotoluene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chloronaphthalene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Chlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitroaniline		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Nitrophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3,3-Dichlorobenzidine		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3-Nitroaniline		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4,6-Dinitro-2-methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloro-3-methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Chloroaniline		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitroaniline		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-Nitrophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-bromophenyl-phenylether		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
4-chlorophenyl-phenylether		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene, hydroxy-		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloro-1-methylethyl) ether		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethoxy)methane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-chloroethyl)ether		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Bis(2-ethylhexyl)phthalate		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Carbazole		NE	NE	0.4 U	0.39 U	2.1 U	0.37 U	2 U	0.37 U	2 U	0.38 U	2.2 U	
Di-n-butylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Di-n-octylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenzofuran		NE	NE	0.4 U	0.39 U	2.1 U	0.37 UJ	2 U	0.37 U	2 U	0.38 U	2.2 U	
Diethylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dimethylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorobutadiene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachlorocyclopentadiene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hexachloroethane		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isophorone		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitroso-di-n-propylamine		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodiphenylamine (1)		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nitrobenzene		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Pentachlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Cyanide	*mg/kg*												
Cyanide		NE	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Organic Carbon	*%*												
TOC		NE	NE	1100 J	230	2600	320	1500	100 U	620	200	29000	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED03-05	RPSED03-05	RPSED03-06	RPSED03-06(6-7)	RPSED03-07	RPSED03-07
				Sample Name	RPSED03-05(3.8-4)	RPSED03-05(9-10)	RPSED03-06(0-0.25)	RPSED03-06(6-7)	RPSED03-07(0-0.25)	RPSED03-07 (5-6)
				Start Depth	3.8	9	0	6	0	5
				End Depth	4	10	0.25	7	0.25	6
				Depth Unit	ft	ft	ft	ft	ft	ft
				Sample Date	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**							
BTEX	mg/kg									
Benzene		NE	NE	NA	NA	NA	NA	NA	NA	
Toluene		NE	NE	NA	NA	NA	NA	NA	NA	
Ethyl benzene		NE	NE	NA	NA	NA	NA	NA	NA	
Xylene (total)		NE	NE	NA	NA	NA	NA	NA	NA	
Total BTEX		NE	NE	NA	NA	NA	NA	NA	NA	
Other Volatile Organic Compounds	*ug/kg*			NA	NA	NA	NA	NA	NA	
1,1,1-Trichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
1,1,2,2-Tetrachloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
1,1,2-Trichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
1,1-Dichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
1,1-Dichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	
1,2-Dichloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
1,2-Dichloropropane		NE	NE	NA	NA	NA	NA	NA	NA	
2-Butanone		NE	NE	NA	NA	NA	NA	NA	NA	
2-Hexanone		NE	NE	NA	NA	NA	NA	NA	NA	
4-Methyl-2-pentanone		NE	NE	NA	NA	NA	NA	NA	NA	
Acetone		NE	NE	NA	NA	NA	NA	NA	NA	
Bromodichloromethane		NE	NE	NA	NA	NA	NA	NA	NA	
Bromoform		NE	NE	NA	NA	NA	NA	NA	NA	
Bromomethane		NE	NE	NA	NA	NA	NA	NA	NA	
Carbon disulfide		NE	NE	NA	NA	NA	NA	NA	NA	
Carbon tetrachloride		NE	NE	NA	NA	NA	NA	NA	NA	
Chlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
Chloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
Chloroform		NE	NE	NA	NA	NA	NA	NA	NA	
Chloromethane		NE	NE	NA	NA	NA	NA	NA	NA	
Dibromochloromethane		NE	NE	NA	NA	NA	NA	NA	NA	
Methylene chloride		NE	NE	NA	NA	NA	NA	NA	NA	
Styrene		NE	NE	NA	NA	NA	NA	NA	NA	
Tetrachloroethene		NE	NE	NA	NA	NA	NA	NA	NA	
Trichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	
Vinyl chloride		NE	NE	NA	NA	NA	NA	NA	NA	
cis-1,2-Dichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	
cis-1,3-Dichloropropene		NE	NE	NA	NA	NA	NA	NA	NA	
trans-1,2-Dichloroethene		NE	NE	NA	NA	NA	NA	NA	NA	
trans-1,3-Dichloropropene		NE	NE	NA	NA	NA	NA	NA	NA	
Semivolatile Organic Compounds	*mg/kg*									
Carcinogenic PAHs										
Benzo(a)anthracene		0.26	1.6	28	0.39 U	1.9 J	0.36 U	2.6 J	0.37 U	
Benzo(a)pyrene		0.43	1.6	22	0.39 U	1.4 J	0.36 U	2 J	0.37 U	
Benzo(b)fluoranthene		NE	NE	16	0.39 U	1.3 J	0.36 U	1.6 J	0.37 U	
Benzo(k)fluoranthene		NE	NE	6.2	0.39 U	0.53 J	0.36 U	0.79 J	0.37 U	
Chrysene		0.38	2.8	24	0.39 U	1.8 J	0.36 U	2.6 J	0.37 U	
Dibenzo(a,h)anthracene		0.06	0.26	2.2	0.39 U	0.24 J	0.36 U	0.32 J	0.37 U	
Indeno(1,2,3-cd)pyrene		NE	NE	6.3	0.39 U	0.66 J	0.36 U	0.8 J	0.37 U	
Total Carcinogenic PAHs		NE	NE	104.7	0	7.83	0	10.71	0	
Non-Carcinogenic PAHs										
2-Methylnaphthalene		0.07	0.67	12	0.39 U	2.2 U	0.36 U	2.7 U	0.37 U	
Acenaphthene		0.02	0.5	170 J	0.39 U	2.2 U	0.36 U	2.7 U	0.37 U	
Acenaphthylene		0.04	0.64	8.4	0.39 U	0.51 J	0.36 U	0.76 J	0.37 U	
Anthracene		0.09	1.1	63	0.39 U	0.58 J	0.36 U	1.6 J	0.37 U	
Benzo(g,h,i)perylene		NE	NE	7.7	0.39 U	0.82 J	0.36 U	0.96 J	0.37 U	
Fluoranthene		0.6	5.1	49	0.39 U	2.2	0.36 U	3.4	0.37 U	
Fluorene		0.02	0.54	50	0.39 U	2.2 U	0.36 U	2.7 U	0.37 U	
Naphthalene		0.16	2.1	190	0.39 U	2.2 U	0.36 U	2.7 U	0.37 U	
Phenanthrene		0.24	1.5	200	0.39 U	0.77 J	0.36 U	2.4 J	0.37 U	
Pyrene		0.67	2.6	86	0.39 U	5	0.062 J	6.7	0.37 U	
Total Non-Carcinogenic PAHs		NE	NE	836.1	0	9.88	0.062	15.82	0	
Total PAHs		4.02	44.8	940.8	0	17.71	0.062	26.53	0	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

				Location Name	RPSED03-05	RPSED03-05	RPSED03-06	RPSED03-06(6-7)	RPSED03-07	RPSED03-07
				Sample Name	RPSED03-05(3.8-4)	RPSED03-05(9-10)	RPSED03-06(0-0.25)	RPSED03-06(6-7)	RPSED03-07(0-0.25)	RPSED03-07 (5-6)
				Start Depth	3.8	9	0	6	0	5
				End Depth	4	10	0.25	7	0.25	6
				Depth Unit	ft	ft	ft	ft	ft	ft
				Sample Date	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003	11/17/2003
Analyte	**Units**	**New York Cleanup Objective ERL**	**New York Cleanup Objective ERM**							
Other Semivolatile Organic Compounds	*ug/kg*									
1,2,4-Trichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
1,2-Dichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
1,3-Dichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
1,4-Dichlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
2,4,5-Trichlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	
2,4,6-Trichlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	
2,4-Dichlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	
2,4-Dimethylphenol		NE	NE	NA	NA	NA	NA	NA	NA	
2,4-Dinitrophenol		NE	NE	NA	NA	NA	NA	NA	NA	
2,4-Dinitrotoluene		NE	NE	NA	NA	NA	NA	NA	NA	
2,6-Dinitrotoluene		NE	NE	NA	NA	NA	NA	NA	NA	
2-Chloronaphthalene		NE	NE	NA	NA	NA	NA	NA	NA	
2-Chlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	
2-Methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	
2-Nitroaniline		NE	NE	NA	NA	NA	NA	NA	NA	
2-Nitrophenol		NE	NE	NA	NA	NA	NA	NA	NA	
3,3-Dichlorobenzidine		NE	NE	NA	NA	NA	NA	NA	NA	
3-Nitroaniline		NE	NE	NA	NA	NA	NA	NA	NA	
4,6-Dinitro-2-methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	
4-Chloro-3-methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	
4-Chloroaniline		NE	NE	NA	NA	NA	NA	NA	NA	
4-Methylphenol		NE	NE	NA	NA	NA	NA	NA	NA	
4-Nitroaniline		NE	NE	NA	NA	NA	NA	NA	NA	
4-Nitrophenol		NE	NE	NA	NA	NA	NA	NA	NA	
4-bromophenyl-phenylether		NE	NE	NA	NA	NA	NA	NA	NA	
4-chlorophenyl-phenylether		NE	NE	NA	NA	NA	NA	NA	NA	
Benzene, hydroxy-		NE	NE	NA	NA	NA	NA	NA	NA	
Bis(2-chloro-1-methylethyl) ether		NE	NE	NA	NA	NA	NA	NA	NA	
Bis(2-chloroethoxy)methane		NE	NE	NA	NA	NA	NA	NA	NA	
Bis(2-chloroethyl)ether		NE	NE	NA	NA	NA	NA	NA	NA	
Bis(2-ethylhexyl)phthalate		NE	NE	NA	NA	NA	NA	NA	NA	
Butylbenzylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	
Carbazole		NE	NE	2.6	0.39 U	2.2 U	0.36 U	2.7 U	0.37 U	
Di-n-butylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	
Di-n-octylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	
Dibenzofuran		NE	NE	6.6	0.39 U	2.2 U	0.36 U	2.7 U	0.37 U	
Diethylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	
Dimethylphthalate		NE	NE	NA	NA	NA	NA	NA	NA	
Hexachlorobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
Hexachlorobutadiene		NE	NE	NA	NA	NA	NA	NA	NA	
Hexachlorocyclopentadiene		NE	NE	NA	NA	NA	NA	NA	NA	
Hexachloroethane		NE	NE	NA	NA	NA	NA	NA	NA	
Isophorone		NE	NE	NA	NA	NA	NA	NA	NA	
N-Nitroso-di-n-propylamine		NE	NE	NA	NA	NA	NA	NA	NA	
N-Nitrosodiphenylamine (1)		NE	NE	NA	NA	NA	NA	NA	NA	
Nitrobenzene		NE	NE	NA	NA	NA	NA	NA	NA	
Pentachlorophenol		NE	NE	NA	NA	NA	NA	NA	NA	
Total Cyanide	*mg/kg*									
Cyanide		NE	NE	NA	NA	NA	NA	NA	NA	
Total Organic Carbon	*%*									
TOC		NE	NE	730	280	14000	240	16000	350	

Table 4. Post Remediation Sediment Impacts
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Notes:

ERL - Effects Range Low
ERM - Effects Range Medium
NE - not established
NA - not analyzed
ND - indicates standard is applicable to analyte detection limit
J - estimated value
U - indicates not detected to the reporting limit for organic analysis and the method detection limit for inorganic analysis
D - identifies all compounds in the analysis completed at secondary dilution factor
B - analyte was found within the laboratory method blank as well as the sample
N - spiked sample recovery was not within control limits (metals)
E - compound concentration exceeds the calibration range
mg/kg - milligrams/kilogram or parts per million (ppm)
ug/kg - micrograms/kilogram or parts per billion (ppb)
BTEX is benzene, toluene, ethylbenzene, and xylene.
PAHs are polycyclic aromatic hydrocarbons.

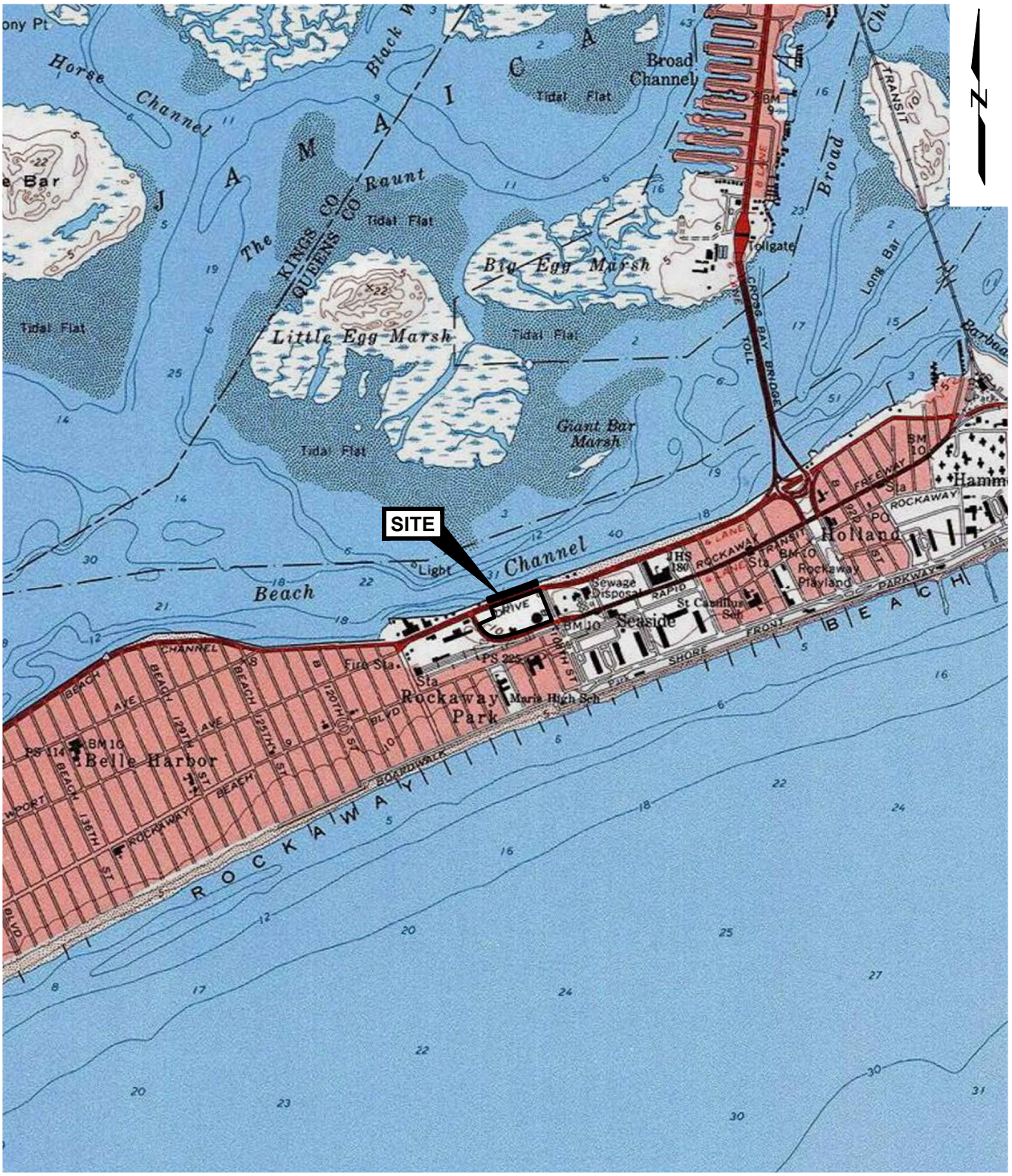
Table 6. Monitoring Well Construction Details and Sampling Schedule
Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

Monitoring Well ID	Well Diameter/Type	Screened Interval (ft bgs)	Sump Interval (ft bgs)	Total Depth (ft bgs)	Top of Casing Elevation (feet NAVD88)	Location	Sampling Schedule	Analysis
RPMW-01S	2-inch PVC	5-15	15-17	17	6.87	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-01I	2-inch PVC	35-45	45-47	47	6.69	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-02S	2-inch PVC	5-15	15-17	17	10.04	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-02I	2-inch PVC	35-45	45-47	47	10.03	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-03S	2-inch PVC	5-15	15-17	17	6.22	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-03I	2-inch PVC	35-45	45-47	47	6.41	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-03D	2-inch PVC	65-75	75-77	77	7.12	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-04S	2-inch PVC	5-15	15-17	17	Not Surveyed	Substation	Annual	VOCs, SVOCs, Total and Free CN
RPMW-04I	2-inch PVC	35-45	45-47	47	Not Surveyed	Substation	Annual	VOCs, SVOCs, Total and Free CN
RPMW-11S	2-inch PVC	5-15	15-17	17	8.18	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-11I	2-inch PVC	35-45	45-47	47	8.2	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-11D	2-inch PVC	65-75	75-77	77	8.12	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-14S	2-inch PVC	5-15	15-17	17	12.37	On-Site	Annual	VOCs, SVOCs, Total and Free CN
RPMW-14I	2-inch PVC	35-45	45-47	47	11.7	On-Site	Annual	VOCs, SVOCs, Total and Free CN
RPMW-17S	2-inch PVC	5-15	15-17	17	6.03	Beach 108th Street	Annual	VOCs, SVOCs, Total and Free CN
RPMW-17I	2-inch PVC	35-45	45-47	47	Not Surveyed	Beach 108th Street	Annual	VOCs, SVOCs, Total and Free CN
RPMW-17D	2-inch PVC	65-75	75-77	77	Not Surveyed	Beach 108th Street	Annual	VOCs, SVOCs, Total and Free CN
RPMW-19S	1-inch PVC	2.3-12.3	NA	12.3	Not Surveyed	Beach Channel Drive	Annual	VOCs, SVOCs, Total and Free CN
RPMW-26S	1-inch PVC	3-13	NA	13	Not Surveyed	Beach 108th Street	Annual	VOCs, SVOCs, Total and Free CN
RW-01A	4-inch PVC	22-32	32-37	37	8.55	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-01B	4-inch PVC	41-51	51-56	56	8.64	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-01C	4-inch PVC	61-71	71-76	76	8.62	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-02A	4-inch PVC	15-25	25-30	30	8.65	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-02B	4-inch PVC	35-45	45-50	50	8.96	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-02C	4-inch PVC	60-70	70-75	75	8.79	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-03	4-inch PVC	15-25	25-30	30	10.2	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-04A	4-inch PVC	30-40	40-45	45	9.98	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-04B	4-inch PVC	40-60	60-65	65	9.69	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-05A	4-inch PVC	10-20	20-25	25	9.24	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-05B	4-inch PVC	25-40	40-45	45	9.43	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-05C	4-inch PVC	40-50	50-55	55	9.65	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-06A	4-inch PVC	10-20	20-25	25	9.39	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-06B	4-inch PVC	50-60	60-65	65	9.77	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-07A	4-inch PVC	10-30	30-35	35	10.05	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-07B	4-inch PVC	40-60	60-65	65	10.32	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-08B	4-inch PVC	40-60	60-65	65	9.65	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-09	4-inch PVC	5-30	30-35	35	10.54	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-10	4-inch PVC	5-30	30-35	35	10.73	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-11	4-inch PVC	20-40	40-45	45	10.88	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-12A	4-inch PVC	20-35	35-40	40	10.67	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-12B	4-inch PVC	35-50	50-55	55	11.1	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-13A	4-inch PVC	5-20	20-25	25	8.75	On-Site	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-14B	4-inch PVC	10-30	30-35	35	8.62	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-15A	4-inch PVC	40-60	60-65	65	8.87	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-16A	4-inch PVC	10-30	30-35	35	8.34	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-16B	4-inch PVC	90-110	110-115	115	9.24	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-17A	4-inch PVC	10-30	30-35	35	7.9	On-Site	Baseline*	VOCs, SVOCs, Total and Free CN
RW-18A	4-inch PVC	22-32	32-37	37	8.51	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-18B	4-inch PVC	42-52	52-57	57	8.53	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-18C	4-inch PVC	62-72	72-77	77	8.5	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-19A	4-inch PVC	19-29	29-34	34	8.49	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-19B	4-inch PVC	41-51	51-56	56	8.53	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-19C	4-inch PVC	61-71	71-76	76	8.53	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-20A	4-inch PVC	22-32	32-37	37	8.39	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-20B	4-inch PVC	41-51	51-56	56	8.35	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN
RW-20C	4-inch PVC	61-71	71-76	76	8.21	Beach Channel Drive	Baseline, Annual*	VOCs, SVOCs, Total and Free CN

Notes:

ft bgs - Feet below ground surface
PVC - polyvinyl chloride
NAVD 88 - North American Vertical Datum 1988
NA - Not Applicable
VOCs - Volatile Organic Compounds
SVOCs - Semi-Volatile Organic Compounds
CN - Cyanide
* Baseline sampling conducted in October 2016, annual sampling will be conducted in Q3 or Q4 annually.

FIGURES



SOURCE:

U.S.G.S 7.5 Minute Topographic Maps, accessed via ArcGIS for AutoCAD

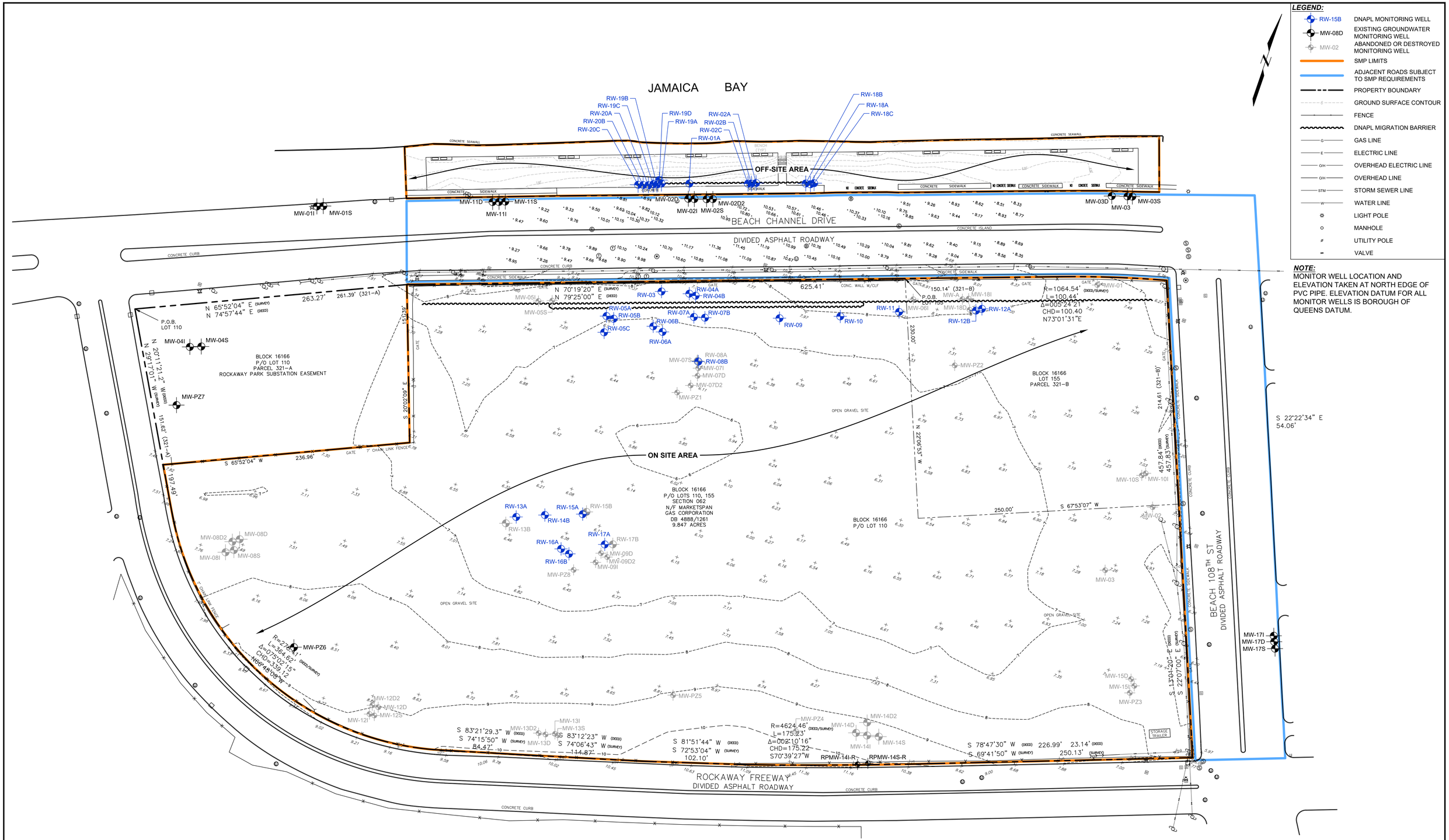
©2013 National Geographic Society, i-cubed.

0 2000 4000

SCALE: 1" = 2000'

Site Management Plan Rockaway Park Former MGP Site Rockaway Park, New York	GEI Consultants	SITE LOCATION FIGURE
nationalgrid	Project 093150	April 2022 Fig. 1

\\blm-pzcc-1\ \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_SLM.dwg - 1/17/2022



LEGEND:

- RW-15B — DNAPL MONITORING WELL
- MW-08D — EXISTING GROUNDWATER MONITORING WELL
- MW-02 — ABANDONED OR DESTROYED MONITORING WELL
- SMP LIMITS
- ADJACENT ROADS SUBJECT TO SMP REQUIREMENTS
- PROPERTY BOUNDARY
- GROUND SURFACE CONTOUR
- FENCE
- DNAPL MIGRATION BARRIER
- GAS LINE
- ELECTRIC LINE
- OVERHEAD ELECTRIC LINE
- OVERHEAD LINE
- STORM SEWER LINE
- WATER LINE
- LIGHT POLE
- MANHOLE
- UTILITY POLE
- VALVE

NOTE:
MONITOR WELL LOCATION AND ELEVATION TAKEN AT NORTH EDGE OF PVC PIPE. ELEVATION DATUM FOR ALL MONITOR WELLS IS BOROUGH OF QUEENS DATUM.

SOURCE:
BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

0 40 80
SCALE: 1" = 40'

Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

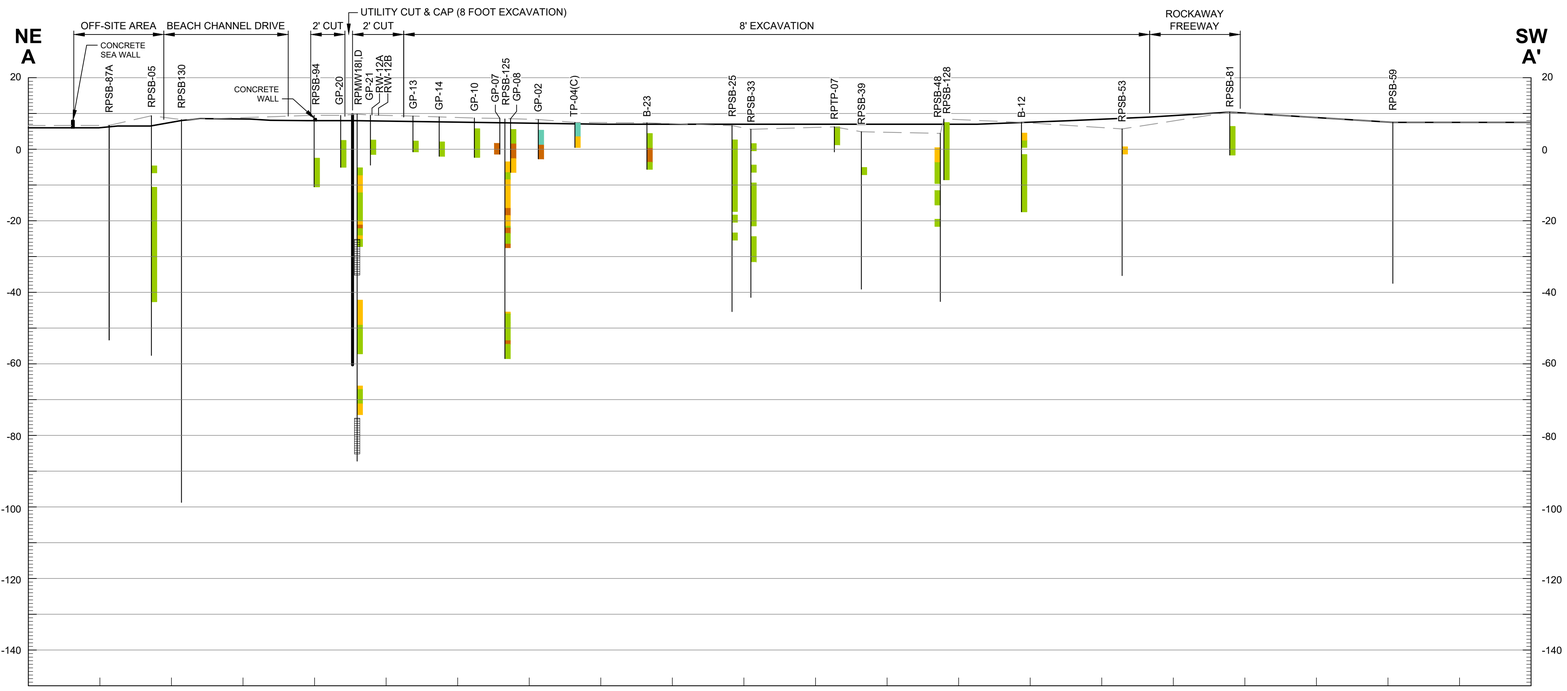
nationalgrid

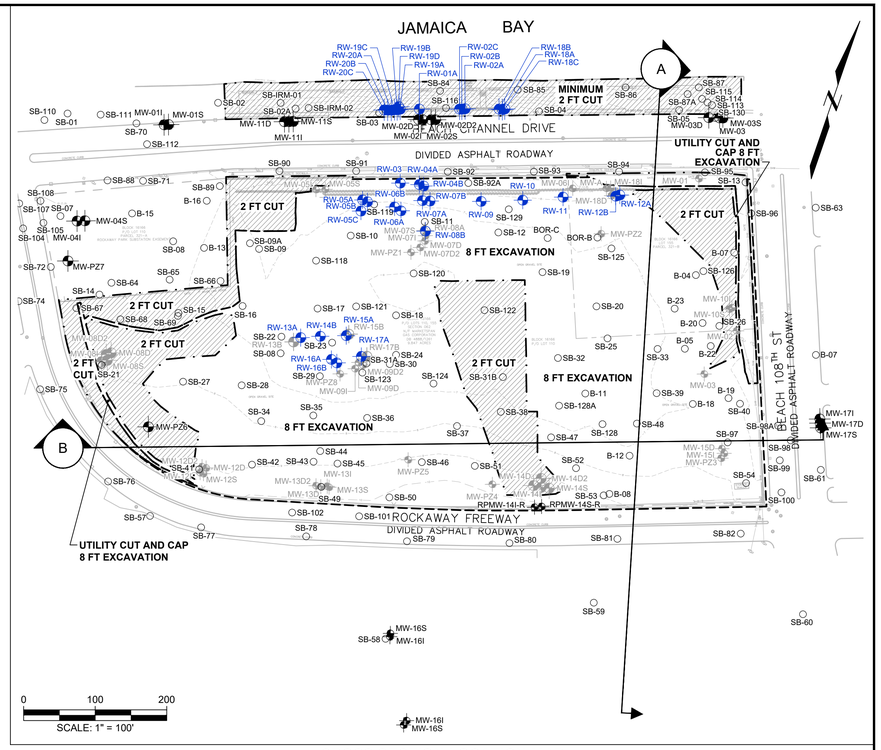
GEI Consultants

ON-SITE AND OFF-SITE PROPERTY BOUNDARIES

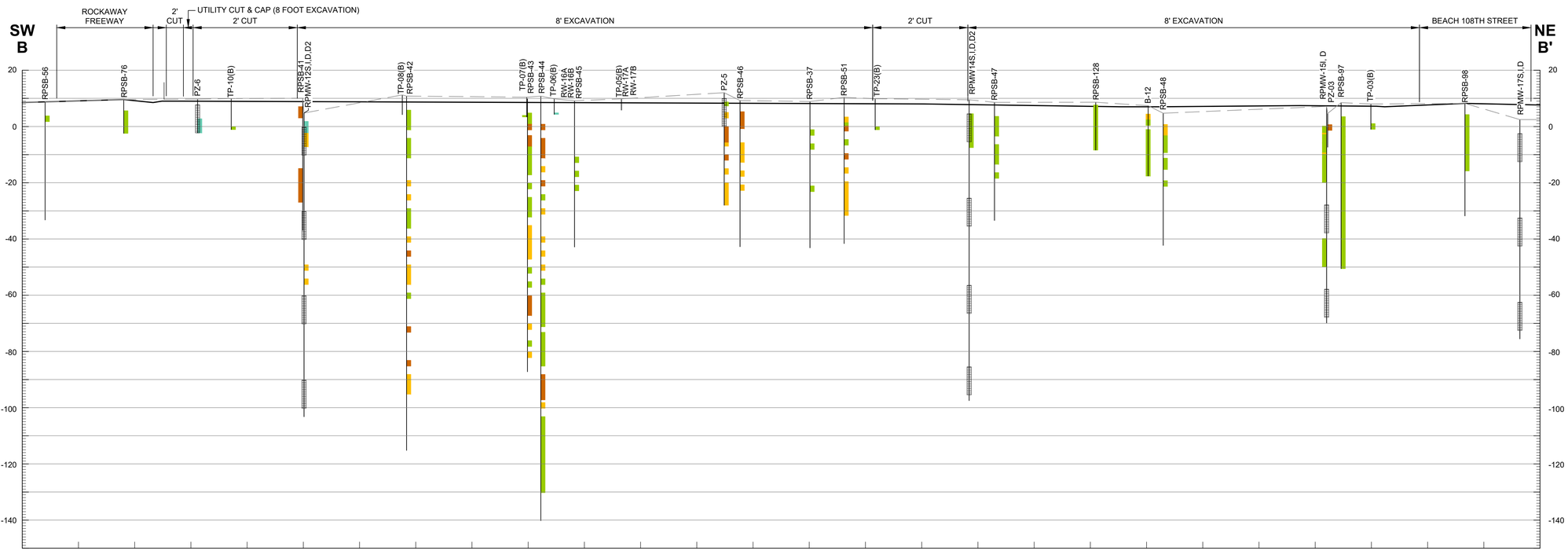
Project 093150 | April 2022 | Fig. 2

\\WAS-TMORTON \\blm-pzcc-11\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022





CROSS SECTION LOCATION MAP



LEGEND:

- GROUND SURFACE CONTOUR
- AREA OF 2' CUT
- AREA OF 8' EXCAVATION
- RW-01A — DNAPL MONITORING WELL
- MW-08D — EXISTING GROUNDWATER MONITORING WELL
- MW-02 — ABANDONED OR DESTROYED MONITORING WELL
- PROPERTY BOUNDARY
- FENCE
- DNAPL MIGRATION BARRIER

CROSS SECTIONS

- RPMW-17S — MONITORING WELL, SOIL BORING OR PIEZOMETER IDENTIFICATION
- WELL SCREEN INTERVAL
- PRE-REMEDIATION GROUND SURFACE
- POST-REMEDIATION GROUND SURFACE

PHYSICAL OBSERVATIONS

- SOLID TAR
- TAR SATURATED
- BLEBS, GLOBS, LENSES, GRAIN-COATING, SHEENS
- STAINING

SOURCE:
BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

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Rockaway Park Former MGP Site
Rockaway Park, New York

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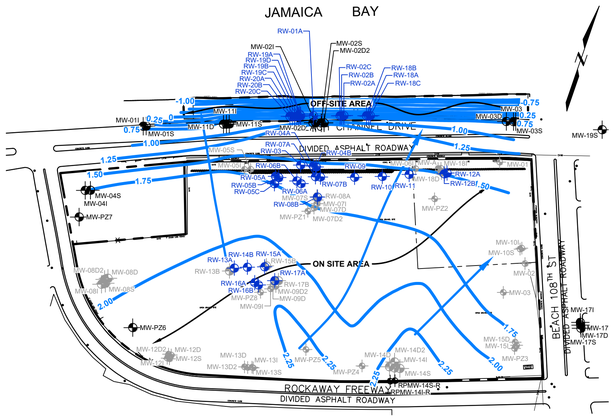
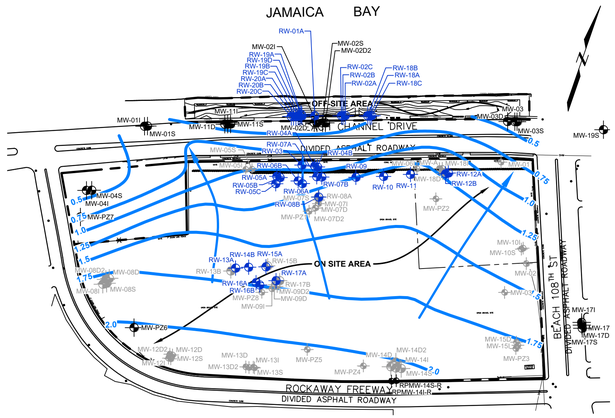
GEOLOGIC CROSS SECTIONS

Project 093150 | April 2022 | Fig. 3

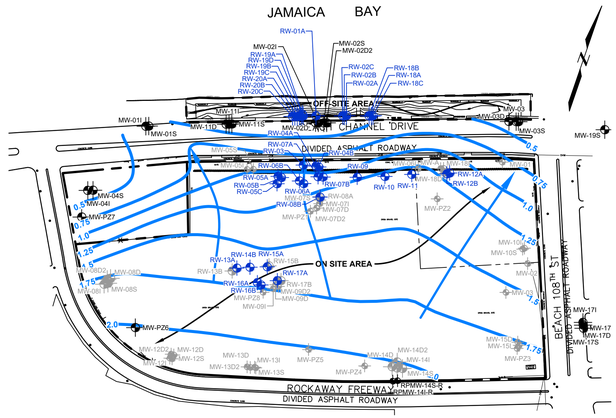
\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022



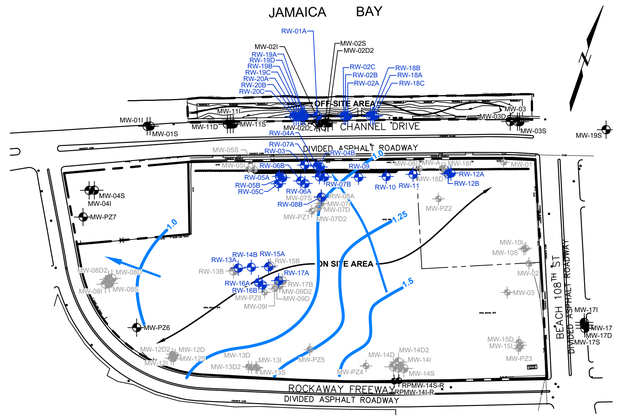
SHALLOW LOW TIDE
(SCREENED INTERVAL: 2 - 17 ft bgs)



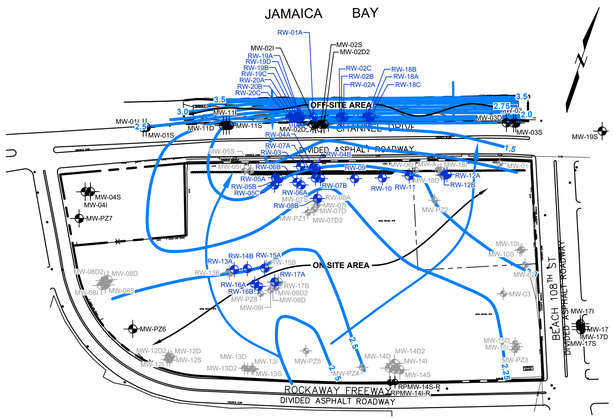
INTERMEDIATE LOW TIDE
(SCREENED INTERVAL: 17 - 45 ft bgs)



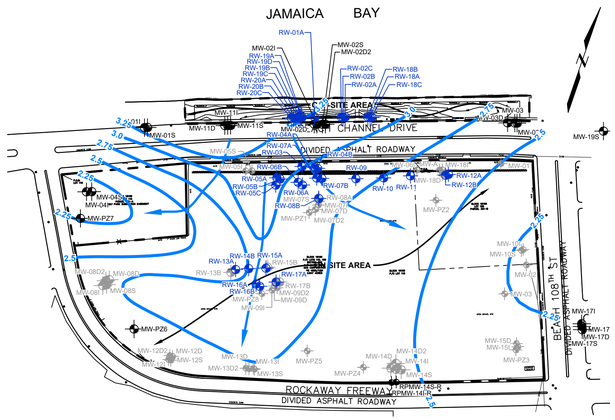
DEEP LOW TIDE
(SCREENED INTERVAL: 45 - 90 ft bgs)



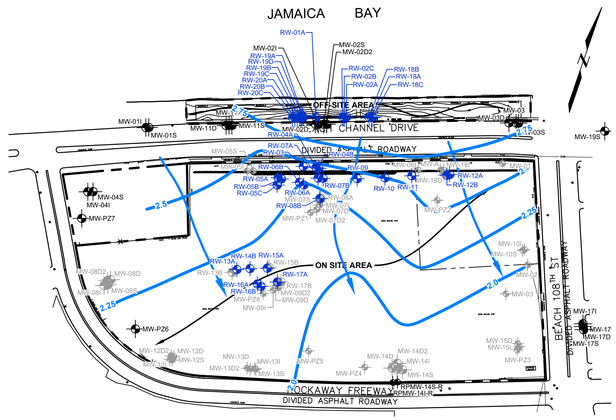
DEEP 2 LOW TIDE
(SCREENED INTERVAL: 90 - 105 ft bgs)



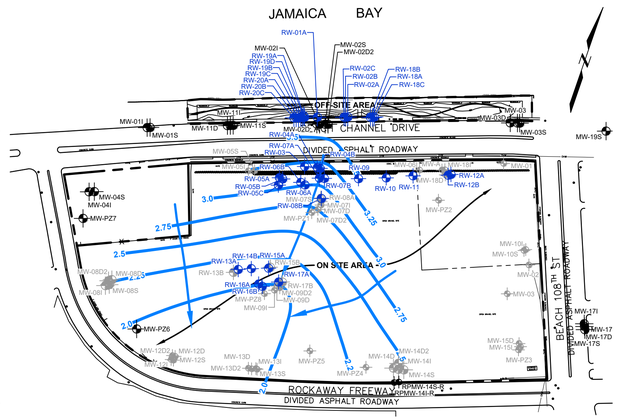
SHALLOW HIGH TIDE
(SCREENED INTERVAL: 2 - 17 ft bgs)



INTERMEDIATE HIGH TIDE
(SCREENED INTERVAL: 17 - 45 ft bgs)



DEEP HIGH TIDE
(SCREENED INTERVAL: 45 - 90 ft bgs)



DEEP 2 HIGH TIDE
(SCREENED INTERVAL: 90 - 105 ft bgs)

LEGEND:

1.5	GROUNDWATER CONTOUR
	GROUNDWATER FLOW DIRECTION
	PROPERTY BOUNDARY
	FENCE
	DNAPL MIGRATION BARRIER
ft bgs	FEET BELOW GROUND SURFACE

NOTE:
GROUNDWATER CONTOURS ARE BASED ON DATA OBTAINED DURING THE OCTOBER 2016 SAMPLING EVENT.

SOURCE:
BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

0 75' 150' 300'
SCALE: 1" = 150'

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Rockaway Park, New York

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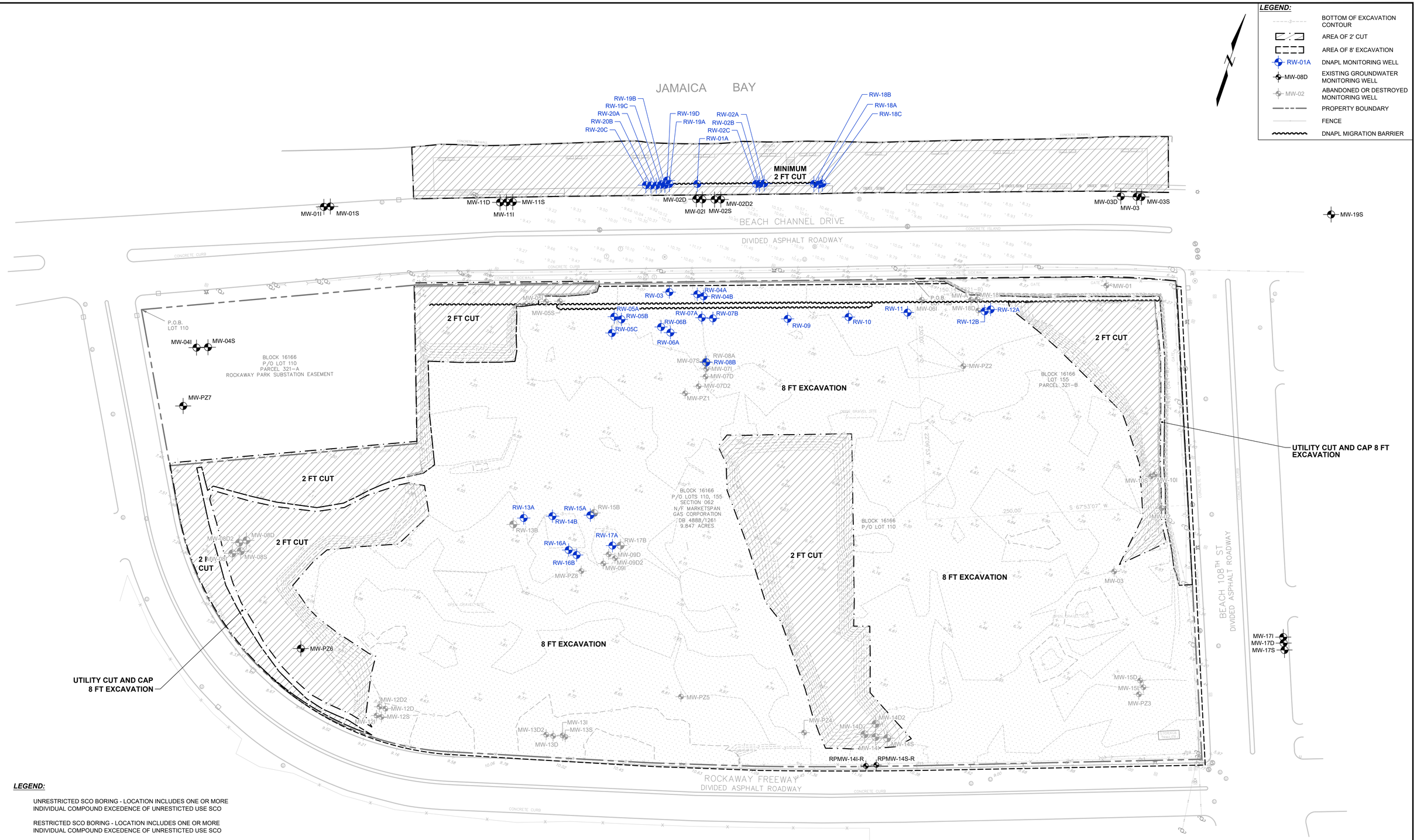
GROUNDWATER CONTOUR MAP

Project 093150 | April 2022 | Fig. 4

\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022



LEGEND:

UNRESTRICTED SCO BORING - LOCATION INCLUDES ONE OR MORE INDIVIDUAL COMPOUND EXCEDENCE OF UNRESTICTED USE SCO

RESTRICTED SCO BORING - LOCATION INCLUDES ONE OR MORE INDIVIDUAL COMPOUND EXCEDENCE OF UNRESTICTED USE SCO

COMMERCIAL SCO BORING - LOCATION INCLUDES ONE OR MORE INDIVIDUAL COMPOUND EXCEDENCE OF UNRESTICTED USE SCO

INDUSTRIAL SCO BORING - LOCATION INCLUDES ONE OR MORE INDIVIDUAL COMPOUND EXCEDENCE OF UNRESTICTED USE SCO

SOURCE:

BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

0 40 80
SCALE: 1" = 40'

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Rockaway Park Former MGP Site
Rockaway Park, New York

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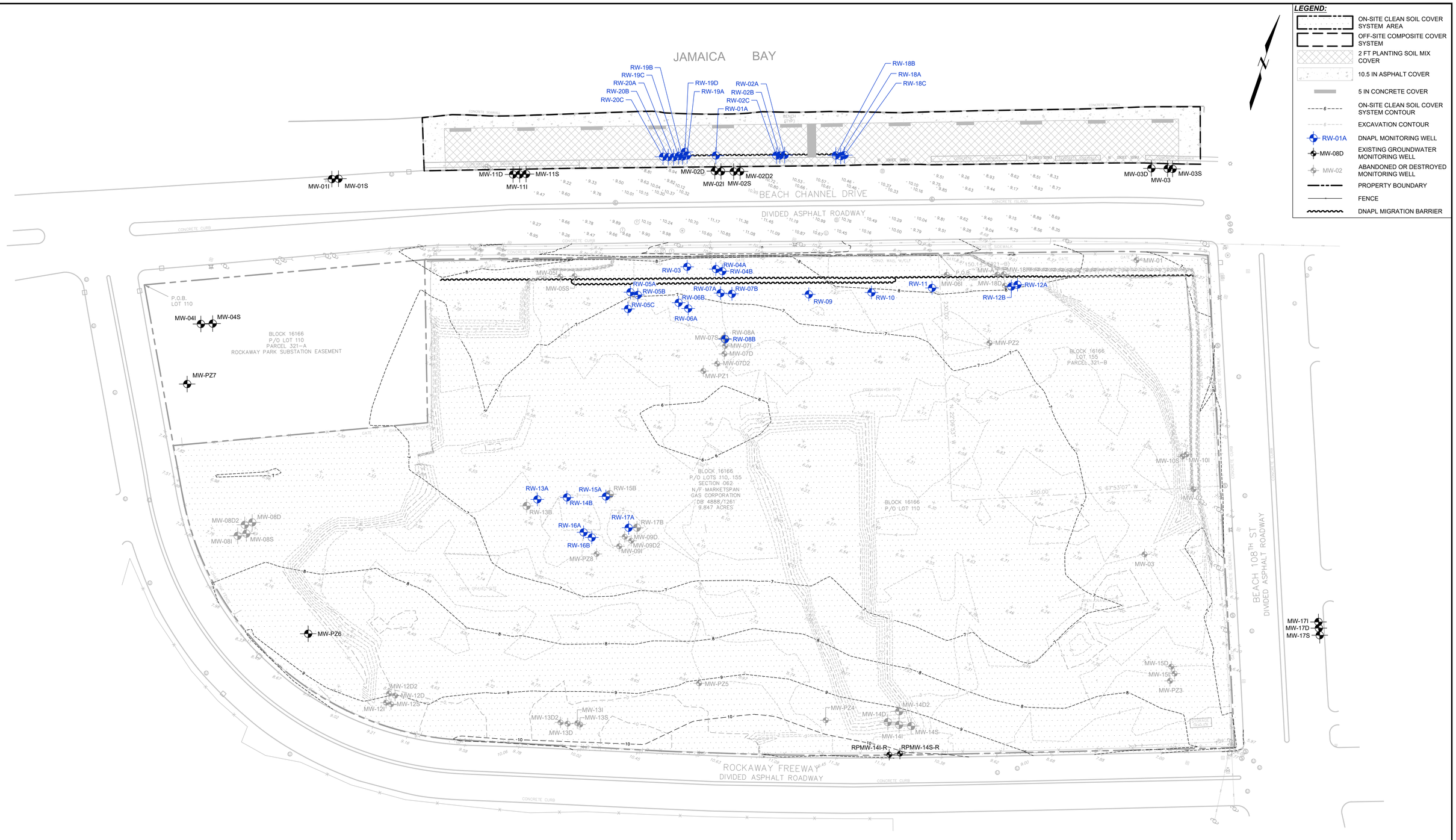
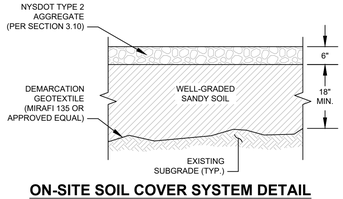
EXTENT OF REMEDIAL EXCAVATION PERFORMED

Project 093150 | April 2022 | Fig. 5

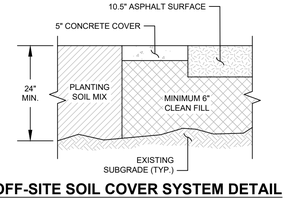
\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022





ON-SITE SOIL COVER SYSTEM DETAIL

NOTE: NOT TO SCALE



OFF-SITE SOIL COVER SYSTEM DETAIL

NOTE: NOT TO SCALE

0 40 80

SCALE: 1" = 40'

SOURCE:

1. BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

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LOCATION OF ENGINEERING CONTROLS

Project 093150 | April 2022 | Fig. 6

\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022

LEGEND:

- RW-01A — DNAPL MONITORING WELL
- MW-08D — EXISTING GROUNDWATER MONITORING WELL
- MW-02 — ABANDONED OR DESTROYED MONITORING WELL
- PROPERTY BOUNDARY
- GROUND SURFACE CONTOUR
- FENCE
- DNAPL MIGRATION BARRIER

N

JAMAICA BAY

RW-19B, RW-19C, RW-20A, RW-20B, RW-20C, RW-19D, RW-19A, RW-02A, RW-02B, RW-02C, RW-01A, RW-18B, RW-18A, RW-18C

MW-01I, MW-01S, MW-11D, MW-11I, MW-11S, MW-02D, MW-02I, MW-02S, MW-02D2, MW-03D, MW-03, MW-03S

BEACH CHANNEL DRIVE
DIVIDED ASPHALT ROADWAY

MW-19S

RW-03, RW-04A, RW-04B, MW-05I, MW-05S, RW-05A, RW-05B, RW-05C, RW-06A, RW-06B, RW-07A, RW-07B, RW-09, RW-10, RW-11, MW-06I, MW-A, MW-18I, MW-18D, RW-12A, RW-12B, MW-01

P.O.B. LOT 110

MW-04I, MW-04S

BLOCK 16166
P/O LOT 110
PARCEL 321–A
ROCKAWAY PARK SUBSTATION EASEMENT

MW-PZ7

MW-07S, RW-08A, RW-08B, MW-07I, MW-07D, MW-07D2, MW-PZ1

MW-PZ2

BLOCK 16166
LOT 155
PARCEL 321–B

OPEN GRAVEL SITE

150.14' (321–B)
230.00'
214.61' (321–B')
250.00'
N 22°05'53" W
S 67°53'07" W

MW-10S, MW-10I, MW-02

BLOCK 16166
P/O LOTS 110, 155
SECTION 062
N/F MARKETSPAN GAS CORPORATION
DB 4888/1261
9.847 ACRES

BLOCK 16166
P/O LOT 110

RW-13A, RW-15A, RW-15B, RW-14B, RW-13B, RW-17A, RW-17B, RW-16A, RW-16B, MW-09D, MW-09D2, MW-09I, MW-PZ8

MW-08D2, MW-08D, MW-08I, MW-08S

MW-03

MW-17I, MW-17D, MW-17S

BEACH 108TH ST
DIVIDED ASPHALT ROADWAY

MW-PZ6

MW-15D, MW-15I, MW-PZ3

MW-12D2, MW-12D, MW-12I, MW-12S, MW-PZ5, MW-13D2, MW-13I, MW-13S, MW-13D, MW-PZ4, MW-14D2, MW-14D, MW-14S, MW-14I, RPMW-14I-R, RPMW-14S-R

ROCKAWAY FREEWAY
DIVIDED ASPHALT ROADWAY

CONCRETE CURB, CONCRETE SEAWALL, CONCRETE SIDEWALK, CONCRETE ISLAND, CHAIN LINK FENCE, GATE, BENCH (TYP), STAIRS, GUIDE RAIL

0 40 80
SCALE: 1" = 40'

SOURCE:
BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

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Rockaway Park Former MGP Site
Rockaway Park, New York

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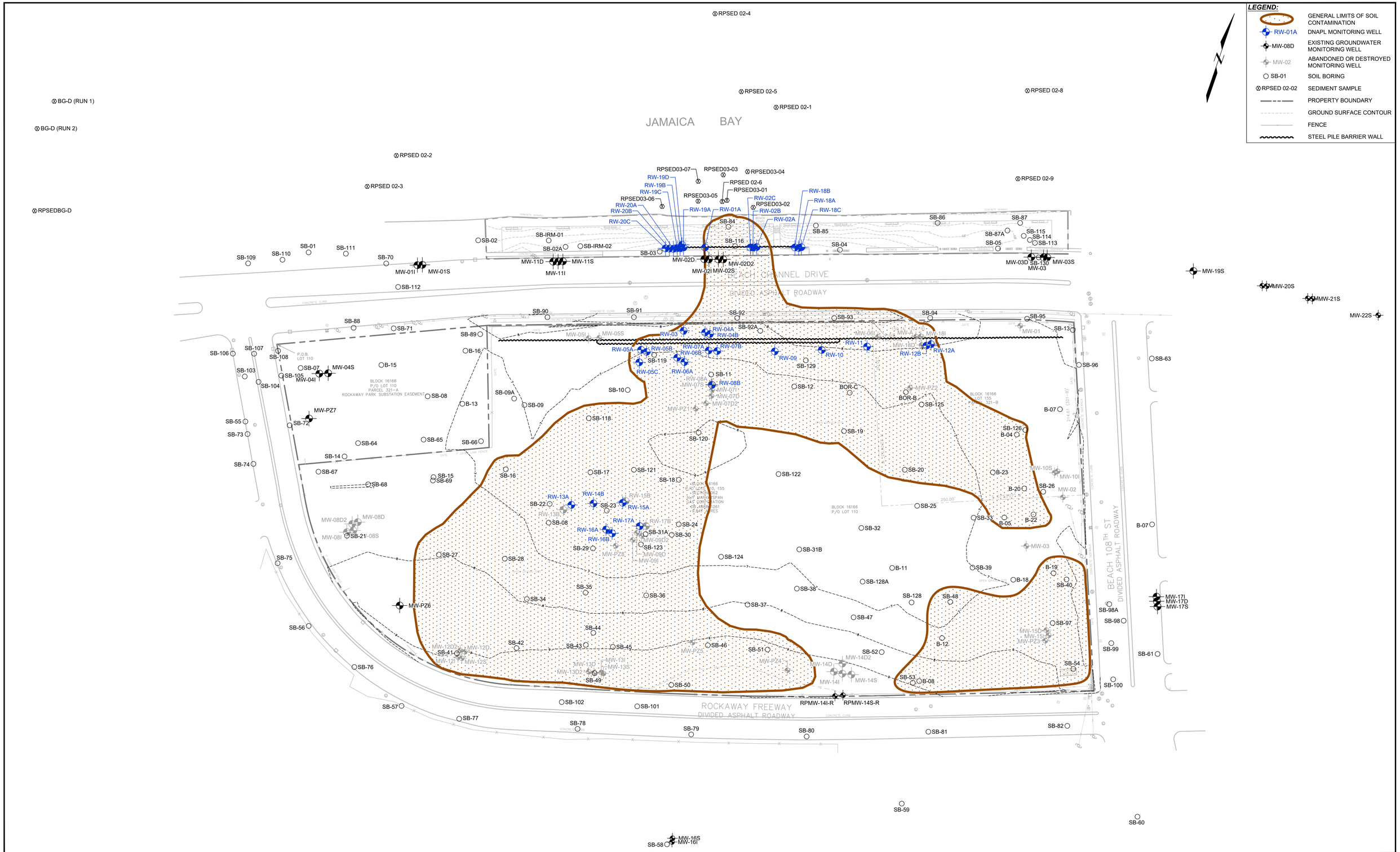
LOCATION OF DNAPL RECOVERY WELLS

Project 093150 | April 2022 | Fig. 7

\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022



SOURCES:

1. BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.
2. FIGURES FROM: *FINAL REMEDIAL INVESTIGATION REPORT*, ROCKAWAY PARK FORMER MANUFACTURED GAS PLANT SITE, PREPARED BY GEI CONSULTANTS, INC., JANUARY 30, 2004.

Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

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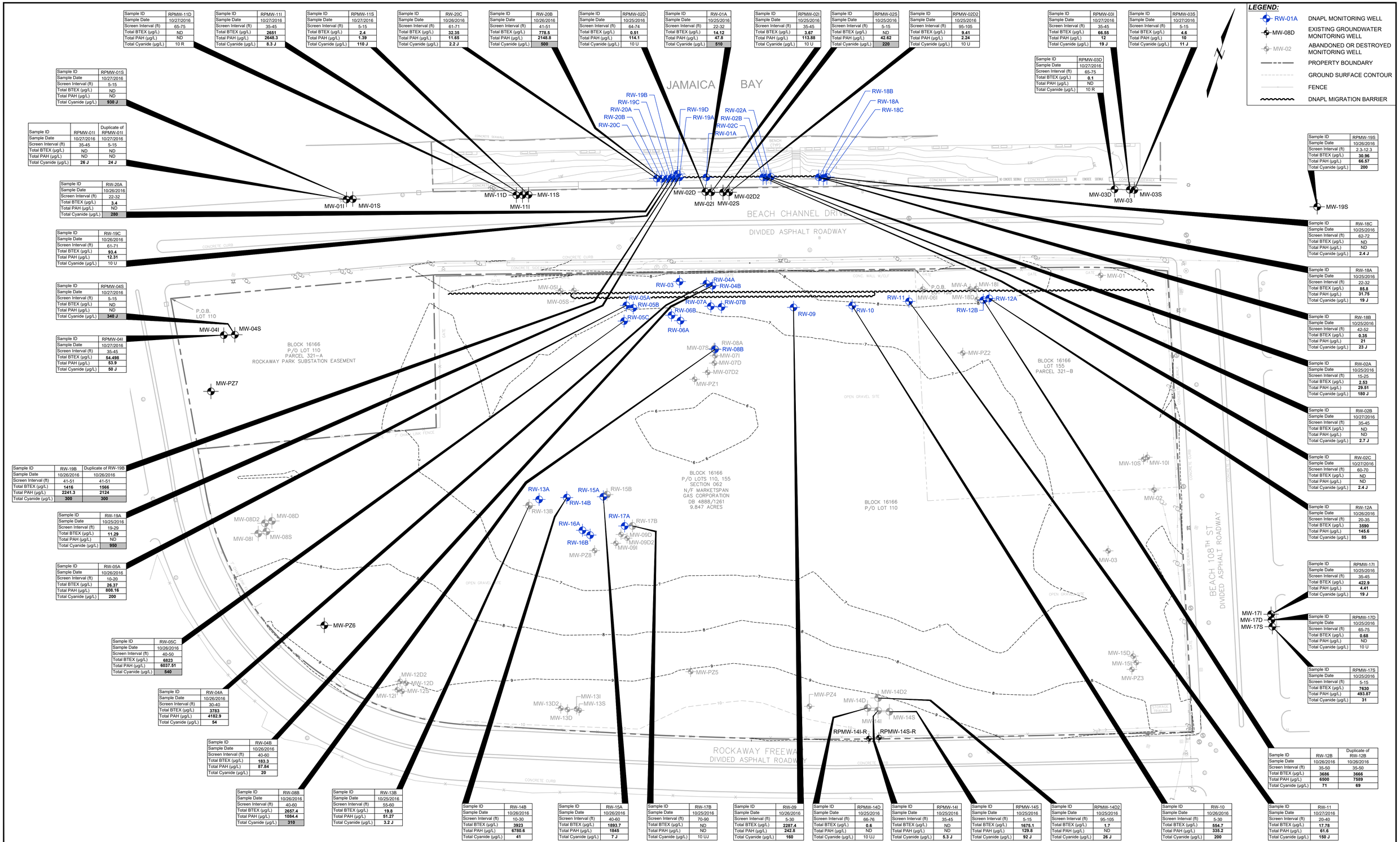
GEI Consultants

POST REMEDY MGP-RELATED SOIL IMPACTS

Project 093150 | April 2022 | Fig. 8

\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022



Sample ID	RPMW-11D
Sample Date	10/27/2016
Screen Interval (ft)	65-75
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	10 R

Sample ID	RPMW-11I
Sample Date	10/27/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	**2651**
Total PAH (µg/L)	**2648.3**
Total Cyanide (µg/L)	**8.3 J**

Sample ID	RPMW-11S
Sample Date	10/27/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	**2.4**
Total PAH (µg/L)	**1.39**
Total Cyanide (µg/L)	**110 J**

Sample ID	RW-20C
Sample Date	10/26/2016
Screen Interval (ft)	61-71
Total BTEX (µg/L)	**32.35**
Total PAH (µg/L)	**11.65**
Total Cyanide (µg/L)	**2.2 J**

Sample ID	RW-20B
Sample Date	10/26/2016
Screen Interval (ft)	41-51
Total BTEX (µg/L)	**778.5**
Total PAH (µg/L)	**2148.8**
Total Cyanide (µg/L)	**500**

Sample ID	RPMW-02D
Sample Date	10/25/2016
Screen Interval (ft)	64-74
Total BTEX (µg/L)	**0.51**
Total PAH (µg/L)	**114.1**
Total Cyanide (µg/L)	10 U

Sample ID	RW-01A
Sample Date	10/25/2016
Screen Interval (ft)	22-32
Total BTEX (µg/L)	**14.12**
Total PAH (µg/L)	**47.8**
Total Cyanide (µg/L)	**510**

Sample ID	RPMW-02I
Sample Date	10/25/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	**3.67**
Total PAH (µg/L)	**113.88**
Total Cyanide (µg/L)	10 U

Sample ID	RPMW-02S
Sample Date	10/25/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	ND
Total PAH (µg/L)	**42.62**
Total Cyanide (µg/L)	**220**

Sample ID	RPMW-02D2
Sample Date	10/25/2016
Screen Interval (ft)	95-105
Total BTEX (µg/L)	**9.41**
Total PAH (µg/L)	**2.24**
Total Cyanide (µg/L)	10 U

Sample ID	RPMW-03I
Sample Date	10/27/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	**66.55**
Total PAH (µg/L)	**12**
Total Cyanide (µg/L)	**19 J**

Sample ID	RPMW-03S
Sample Date	10/27/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	**4.6**
Total PAH (µg/L)	**10**
Total Cyanide (µg/L)	**11 J**

Sample ID	RPMW-03D
Sample Date	10/27/2016
Screen Interval (ft)	65-75
Total BTEX (µg/L)	**0.1**
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	10 R

Sample ID	RPMW-01S
Sample Date	10/27/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**930 J**

Sample ID	RPMW-01I	Duplicate of RPMW-01I
Sample Date	10/27/2016	10/27/2016
Screen Interval (ft)	35-45	5-15
Total BTEX (µg/L)	ND	ND
Total PAH (µg/L)	ND	ND
Total Cyanide (µg/L)	**26 J**	**24 J**

Sample ID	RW-20A
Sample Date	10/26/2016
Screen Interval (ft)	22-32
Total BTEX (µg/L)	**3.4**
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**280**

Sample ID	RW-19C
Sample Date	10/26/2016
Screen Interval (ft)	61-71
Total BTEX (µg/L)	**93.4**
Total PAH (µg/L)	**12.31**
Total Cyanide (µg/L)	10 U

Sample ID	RPMW-04S
Sample Date	10/27/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**340 J**

Sample ID	RPMW-04I
Sample Date	10/27/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	**54.498**
Total PAH (µg/L)	**53.9**
Total Cyanide (µg/L)	**50 J**

Sample ID	RW-19B	Duplicate of RW-19B
Sample Date	10/26/2016	10/26/2016
Screen Interval (ft)	41-51	41-51
Total BTEX (µg/L)	**1416**	**1566**
Total PAH (µg/L)	**2241.3**	**2124**
Total Cyanide (µg/L)	**300**	**300**

Sample ID	RW-19A
Sample Date	10/25/2016
Screen Interval (ft)	19-29
Total BTEX (µg/L)	**11.29**
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**950**

Sample ID	RW-05A
Sample Date	10/26/2016
Screen Interval (ft)	10-20
Total BTEX (µg/L)	**26.37**
Total PAH (µg/L)	**808.16**
Total Cyanide (µg/L)	**200**

Sample ID	RW-05C
Sample Date	10/26/2016
Screen Interval (ft)	40-50
Total BTEX (µg/L)	**6823**
Total PAH (µg/L)	**6037.51**
Total Cyanide (µg/L)	**540**

Sample ID	RW-04A
Sample Date	10/26/2016
Screen Interval (ft)	30-40
Total BTEX (µg/L)	**3783**
Total PAH (µg/L)	**4182.9**
Total Cyanide (µg/L)	**54**

Sample ID	RW-04B
Sample Date	10/26/2016
Screen Interval (ft)	40-60
Total BTEX (µg/L)	**183.3**
Total PAH (µg/L)	**87.84**
Total Cyanide (µg/L)	**20**

Sample ID	RW-08B
Sample Date	10/26/2016
Screen Interval (ft)	40-60
Total BTEX (µg/L)	**2657.4**
Total PAH (µg/L)	**1084.4**
Total Cyanide (µg/L)	**310**

Sample ID	RW-13B
Sample Date	10/25/2016
Screen Interval (ft)	55-60
Total BTEX (µg/L)	**19.8**
Total PAH (µg/L)	**51.27**
Total Cyanide (µg/L)	**3.2 J**

Sample ID	RW-14B
Sample Date	10/26/2016
Screen Interval (ft)	10-30
Total BTEX (µg/L)	**3923**
Total PAH (µg/L)	**6780.6**
Total Cyanide (µg/L)	**41**

Sample ID	RW-15A
Sample Date	10/26/2016
Screen Interval (ft)	40-60
Total BTEX (µg/L)	**1893.7**
Total PAH (µg/L)	**1845**
Total Cyanide (µg/L)	**7 J**

Sample ID	RW-17B
Sample Date	10/25/2016
Screen Interval (ft)	70-90
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	10 UJ

Sample ID	RW-09
Sample Date	10/26/2016
Screen Interval (ft)	5-30
Total BTEX (µg/L)	**2287.4**
Total PAH (µg/L)	**242.8**
Total Cyanide (µg/L)	**160**

Sample ID	RPMW-14D
Sample Date	10/25/2016
Screen Interval (ft)	66-76
Total BTEX (µg/L)	**0.6**
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	10 UJ

Sample ID	RPMW-14I
Sample Date	10/25/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**5.3 J**

Sample ID	RPMW-14S
Sample Date	10/25/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	**1675.1**
Total PAH (µg/L)	**129.8**
Total Cyanide (µg/L)	**92 J**

Sample ID	RPMW-14D2
Sample Date	10/25/2016
Screen Interval (ft)	95-105
Total BTEX (µg/L)	**1.7**
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**26 J**

Sample ID	RW-10
Sample Date	10/26/2016
Screen Interval (ft)	5-30
Total BTEX (µg/L)	**554.7**
Total PAH (µg/L)	**335.2**
Total Cyanide (µg/L)	**200**

Sample ID	RW-11
Sample Date	10/27/2016
Screen Interval (ft)	20-40
Total BTEX (µg/L)	**17.78**
Total PAH (µg/L)	**61.6**
Total Cyanide (µg/L)	**150 J**

Sample ID	RW-12B	Duplicate of RW-12B
Sample Date	10/26/2016	10/26/2016
Screen Interval (ft)	35-50	35-50
Total BTEX (µg/L)	**3686**	**3666**
Total PAH (µg/L)	**6500**	**7589**
Total Cyanide (µg/L)	**71**	**69**

Sample ID	RPMW-19S
Sample Date	10/26/2016
Screen Interval (ft)	2.3-12.3
Total BTEX (µg/L)	**30.96**
Total PAH (µg/L)	**66.57**
Total Cyanide (µg/L)	**200**

Sample ID	RW-18C
Sample Date	10/25/2016
Screen Interval (ft)	62-72
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**2.4 J**

Sample ID	RW-18A
Sample Date	10/25/2016
Screen Interval (ft)	22-32
Total BTEX (µg/L)	**85.8**
Total PAH (µg/L)	**31.75**
Total Cyanide (µg/L)	**19 J**

Sample ID	RW-18B
Sample Date	10/25/2016
Screen Interval (ft)	42-52
Total BTEX (µg/L)	**0.35**
Total PAH (µg/L)	**21**
Total Cyanide (µg/L)	**23 J**

Sample ID	RW-02A
Sample Date	10/25/2016
Screen Interval (ft)	15-25
Total BTEX (µg/L)	**2.53**
Total PAH (µg/L)	**29.51**
Total Cyanide (µg/L)	**180 J**

Sample ID	RW-02B
Sample Date	10/27/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**2.7 J**

Sample ID	RW-02C
Sample Date	10/27/2016
Screen Interval (ft)	60-70
Total BTEX (µg/L)	ND
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	**2.4 J**

Sample ID	RW-12A
Sample Date	10/26/2016
Screen Interval (ft)	20-35
Total BTEX (µg/L)	**3590**
Total PAH (µg/L)	**145.6**
Total Cyanide (µg/L)	**85**

Sample ID	RPMW-17I
Sample Date	10/25/2016
Screen Interval (ft)	35-45
Total BTEX (µg/L)	**422.9**
Total PAH (µg/L)	**4.41**
Total Cyanide (µg/L)	**19 J**

Sample ID	RPMW-17D
Sample Date	10/25/2016
Screen Interval (ft)	65-75
Total BTEX (µg/L)	**0.68**
Total PAH (µg/L)	ND
Total Cyanide (µg/L)	10 U

Sample ID	RPMW-17S
Sample Date	10/25/2016
Screen Interval (ft)	5-15
Total BTEX (µg/L)	**7630**
Total PAH (µg/L)	**493.87**
Total Cyanide (µg/L)	**31**

LEGEND:

- RW-01A — DNAPL MONITORING WELL
- MW-08D — EXISTING GROUNDWATER MONITORING WELL
- MW-02 — ABANDONED OR DESTROYED MONITORING WELL
- PROPERTY BOUNDARY
- GROUND SURFACE CONTOUR
- FENCE
- DNAPL MIGRATION BARRIER

SOURCE:
BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

0 40 80
SCALE: 1" = 40'

Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

nationalgrid

GEI Consultants

Project 093150

POST REMEDY BASELINE GROUNDWATER ANALYTICAL SUMMARY

April 2022 Fig. 9

\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022

0 3000 6000
SCALE: 1" = 3000'

0 4000 8000
SCALE: 1" = 4000'

SOURCE:
2015 NYC DOT TRUCK ROUTE MAP,
http://www.nyc.gov/html/dot/html/motorist/trucks.shtml#map

Site Management Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

nationalgrid

GEI Consultants

TRUCK TRANSPORT ROUTES

Project 093150 | April 2022 | Fig. 10

\\WAS-TMORTON \\blm-pzcc-1\GTB\CAD\Project\National Grid\Rockaway Park\093150\Figures\SMP_2022\093150_SMP_FIGS.dwg - 1/20/2022

APPENDIX A – ENVIRONMENTAL EASEMENT

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

This page is part of the instrument. The City Register will rely on the information provided by you on this page for purposes of indexing this instrument.The information on this page will control for indexing purposes in the event of any conflict with the rest of the document.

2020010800548001002E551A

RECORDING AND ENDORSEMENT COVER PAGE **PAGE 1 OF 11**

Document ID: 2020010800548001 Document Date: 12-16-2019 Preparation Date: 02-06-2020
Document Type: EASEMENT
Document Page Count: 10

PRESENTER:
FIRST AMERICAN TITLE
666 THIRD AVENUE
996114 ACCOM
NEW YORK, NY 10017
212-551-9421
MLETTIERI@FIRSTAM.COM

RETURN TO:
BARCLAY DAMON LLP
125 EAST JEFFERSON STREET
ATTN: JOAN M LAMSON
SYRACUSE, NY 13202

PROPERTY DATA

Borough	Block	Lot		Unit	Address
QUEENS	16166	110	Partial Lot		N/A BEACH CHANNEL DRIVE

Property Type: UTILITY

Borough	Block	Lot		Unit	Address
QUEENS	16166	155	Entire Lot		108-03 BEACH CHANNEL DRIVE

Property Type: UTILITY

CROSS REFERENCE DATA

CRFN_____ *or* DocumentID_____ *or* _____ Year_____ Reel____ Page_____ *or* File Number_____

PARTIES

GRANTOR/SELLER:
KEYSPAN GAS EAST CORPORATION
175 EAST OLD COUNTRY ROAD
HICKSVILLE, NY 11801

GRANTEE/BUYER:
THE PEOPLE OF THE STATE OF NEW YORK
625 BROADWAY
ALBANY, NY 12233

FEES AND TAXES

Mortgage :

Mortgage Amount:	$	0.00
Taxable Mortgage Amount:	$	0.00
Exemption:		
TAXES: County (Basic):	$	0.00
City (Additional):	$	0.00
Spec (Additional):	$	0.00
TASF:	$	0.00
MTA:	$	0.00
NYCTA:	$	0.00
Additional MRT:	$	0.00
TOTAL:	$	0.00
Recording Fee:	$	90.00
Affidavit Fee:	$	0.00

Filing Fee:	$	100.00
NYC Real Property Transfer Tax:	$	0.00
NYS Real Estate Transfer Tax:	$	0.00

RECORDED OR FILED IN THE OFFICE OF THE CITY REGISTER OF THE CITY OF NEW YORK
Recorded/Filed 02-06-2020 14:59
City Register File No.(CRFN): **2020000049004**

City Register Official Signature

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

THIS INDENTURE made this 16th day of December, 2019, between Owner(s) KeySpan Gas East Corporation, having an office at 175 East Old Country Road, Hicksville, New York 11801, County of Nassau, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

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

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

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

WHEREAS, Grantor, is the owner of real property located at the address of Beach Channel Road in the City of New York, County of Queens and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 16166 Lot 110 (part of), being a portion of the property conveyed to Grantor by deed dated May 27, 1998 and recorded in the City Register of the City of New York in Liber and Page 4888/1261.

WHEREAS, Grantor, is the owner of real property located at the address of 108-03 Beach Channel Road in the City of New York, County of Queens and State of New York, known and designated on the tax map of the New York City Department of Finance as tax map parcel number: Block 16166 Lot 155, being a portion of the property conveyed to Grantor by deed dated May 27, 1998 and recorded in the City Register of the City of New York in Liber and Page 4888/1261.

WHEREAS, the property subject to this Environmental Easement (the "Controlled Property") comprises approximately 8.83 +/- acres, and is hereinafter more fully described in the

Land Title Survey dated June 12, 2017 prepared by Kenny, L. Kennon, L.L.S. of Kennon Surveying Services Inc., which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

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

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Order on Consent Index Number: D1-0002-98-11, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

E. Grantor covenants and agrees that until such time as the Environmental Easement is extinguished in accordance with the requirements of ECL Article 71, Title 36 of the ECL, the property deed and all subsequent instruments of conveyance relating to the Controlled Property shall state in at least fifteen-point bold-faced type:

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

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

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

(1) the inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under the direction of the individual set forth at 6 NYCRR Part 375-1.8(h)(3).

(2) the institutional controls and/or engineering controls employed at such site:

(i) are in-place;

(ii) are unchanged from the previous certification, or that any identified changes to the controls employed were approved by the NYSDEC and that all controls are in the Department-approved format; and

(iii) that nothing has occurred that would impair the ability of such control to protect the public health and environment;

(3) the owner will continue to allow access to such real property to evaluate the continued maintenance of such controls;

(4) nothing has occurred that would constitute a violation or failure to comply with any site management plan for such controls;

(5) the report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

(6) to the best of his/her knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and

(7) the information presented is accurate and complete.

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

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

A. Use of the Controlled Property for all purposes not inconsistent with, or limited by the terms of this Environmental Easement;

https://a836-acris.nyc.gov/DS/DocumentSearch/DocumentImageView?doc_id=2020010800548001

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

5. Enforcement

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

B. If any person violates this Environmental Easement, the Grantee may revoke the Certificate of Completion with respect to the Controlled Property.

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

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

E. To the extent there is any conflict or inconsistency between the terms of this Environmental Easement and the SMP, the terms of the SMP will control.

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

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

Parties shall address correspondence to:

Site Number: 241029
Office of General Counsel
NYSDEC
625 Broadway
Albany New York 12233-5500

With a copy to:

Site Control Section
Division of Environmental Remediation

NYSDEC
625 Broadway
Albany, NY 12233

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

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

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

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

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

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https://a836-acris.nyc.gov/DS/DocumentSearch/DocumentImageView?doc_id=2020010800548001

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

KeySpan Gas East Corporation:

By: Charles Willard JSS

Print Name: Charles Willard

Title: Authorized Representative Date: 11/4/2019

Grantor's Acknowledgment

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

On the 4th day of November in the year 2019, before me, the undersigned, personally appeared Charles Willard, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Kelly Marie Likens
Notary Public - State of New York

KELLY MARIE LIKENS NOTARY PUBLIC STATE OF NEW YORK NO. 01LI6396435 QUALIFIED IN ONONDAGA COUNTY COMM. EXP. 08-19-2023

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

By: _____
Michael J. Ryan, Director
Division of Environmental Remediation

Grantee's Acknowledgment

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

On the 16th day of November, in the year 2019, before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

_____
Notary Public - State of New York

JUSTIN F STENERSON
NOTARY PUBLIC, STATE OF NEW YORK
Registration No. 02ST6383061
Qualified in Ulster County
Commission Expires November 13, 2022

SCHEDULE "A" PROPERTY DESCRIPTION

LEGAL DESCRIPTION PER SURVEY
FOR AREA SUBJECT TO ENVIRONMENTAL EASEMENT
NYSDEC SITE ID 152172

SECTION 062, P/O LOTS 110 & 155, BLOCK 16166
ROCKAWAY PARK, NEW YORK CITY
QUEENS COUNTY, NEW YORK

A TRACT OF LAND BEING P/0 LOTS 110 & 155 IN SECTION 062, BLOCK 16166 IN ROCKAWAY PARK, NEW YORK CITY, QUEENS COUNTY, NEW YORK, A TRACT OF LAND CONVEYED PER DEED BOOK 4888 PAGE 1261 OF THE QUEENS COUNTY RECORDS AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE EASTERLY LINE OF ROCKAWAY FREEWAY AND THE SOUTHERLY LINE OF BEACH CHANNEL DRIVE; THENCE,

1. ALONG SAID SOUTHERLY LINE OF BEACH CHANNEL DRIVE NORTH 65° 52' 04" EAST 263.27'; THENCE,

2. CONTINUING ALONG SAID SOUTHERLY LINE THE FOLLOWING TWO COURSES NORTH 70° 19' 20" EAST 625.41'; THENCE,

3. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 1064.54', AN ARC LENGTH OF 100.44', A CENTRAL ANGLE OF 05° 24' 21" WHOSE CHORD BEARS NORTH 73° 01' 31" EAST 100.40' TO THE WESTERLY LINE OF BEACH 108TH STREET; THENCE,

4. ALONG SAID WESTERLY LINE SOUTH 22° 07' 00" EAST 457.83' TO THE NORTHERLY LINE OF THE AFOREMENTIONED ROCKAWAY FREEWAY; THENCE,

5. ALONG SAID NORTHERLY LINE THE FOLLOWING SEVEN COURSES SOUTH 69° 41' 50" WEST 250.13'; THENCE,

6. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 4624.46', AN ARC LENGTH OF 175.23', A CENTRAL ANGLE OF 02° 10' 16" WHOSE CHORD BEARS SOUTH 70° 39' 27" WEST 175.22'; THENCE,

7. SOUTH 72° 53' 04" WEST 102.10'; THENCE,

8. SOUTH 74° 06' 43" WEST 114.87'; THENCE,

9. SOUTH 74° 15' 50" WEST 84.47'; THENCE,

10. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 278.41', AN ARC LENGTH OF 364.62', A CENTRAL ANGLE OF 75° 02' 15" WHOSE CHORD BEARS NORTH 66° 48' 08" WEST 339.12'; THENCE,

11. NORTH 29° 17' 01" WEST 197.49' TO THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT CONTAINING 9.79 ACRES MORE OR LESS.

EXCLUDING FROM ABOVE DESCRIPTION PARCEL DESIGNATED 321-A, EASEMENT TO LIPA, BEING P/0 LOT 110 IN SECTION 062, BLOCK 16166 IN ROCKAWAY PARK, NEW YORK CITY, QUEENS COUNTY, NEW YORK, A TRACT OF LAND CONVEYED PER DOCUMENT ID 2004061400453001 OF THE CITY REGISTER OF THE CITY OF NEW YORK AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE EASTERLY LINE OF ROCKAWAY FREEWAY AND THE SOUTHERLY LINE OF BEACH CHANNEL DRIVE; THENCE,

1. ALONG SAID SOUTHERLY LINE OF BEACH CHANNEL DRIVE NORTH 65° 52' 04" EAST 261.39'; THENCE,

2. ALONG THE EASTERLY BOUNDARY LINE SOUTH 20° 02' 09" EAST 151.39'; THENCE,

3. ALONG LAST MENTIONED PROPERTY LINE SOUTH 65° 52' 04" WEST 236.96'; THENCE,

4. ALONG THE EASTERLY LINE SIDE OF ROCKAWAY FREEWAY NORTH 29° 17' 01" WEST 151.62' TO THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT CONTAINING 0.96 ACRES MORE OR LESS.

https://a836-acris.nyc.gov/DS/DocumentSearch/DocumentImageView?doc_id=2020010800548001 11/11

APPENDIX B – LIST OF SITE CONTACTS

Name	Phone/Email Address
National Grid, Michael Quinlan (Owner and Remedial Party)	(516) 220-4363 michael.quinlan@nationalgrid.com
Matthew O'Neil, P.E. GEI Consultants, Inc., PC (Qualified Environmental Professional)	(401) 533-5152 moneil@geiconsultants.com
Sydney Sobol (NYSDEC Project Manager)	(518) 402-4799 Sydney.sobol@dec.ny.gov
Kylie Murphy, Off-Site Property Representative, New York City Department of Parks & Recreation	(718) 760-6853 kylie.murphy@parks.nyc.gov

APPENDIX C – METES AND BOUNDS

DOCUMENT ID 20040614004530O1
P/O LOT 110 BLOCK 16166
ROCKAWAY PARK SUBSTATION

Q-0023E/239
10/9/04

Description of Parcel P/O #321-A
Rockaway Beach Substation, Easement
Rockaway Park, Queen Tax Map
P/O Lot 110, Section 062, Block 16166
situated in
Rockaway Park, New York City
Queens County, State of New York

Beginning at the northwesterly corner of herein described property line, said true point or place of beginning being more fully described and located as follows:

Beginning at the intersection Rockaway Freeway (easement not shown on the final map of the City of New York) and the southerly side of Beach Channel Drive, the true point or place of beginning;

Running thence along the southerly right-of-way line of Beach Channel Drive North 74°57'44" East 261.39 feet to a point;

Thence along easterly boundary line, South 10°56'29" East 151.39 feet to a point along the southerly property line;

Thence along last mention property line South 74° 57' 44" West 236.96 feet to a point;

Thence along the easterly side of Rockaway Freeway North 20° 11' 21" West 151.62 feet to the true point or place of beginning;

Containing within said bounds 37,626.35 square feet and/or 0.96 acres more or less.

Being and intended to be the part of the same premises conveyed to the party of the first part by deeds recorded with the registrar of the city of New York, Queens County as follows;

Deed Dated	Recorded	Recorded Dated
July 24, 1945	Liber 5048, Page 628	August 18, 1945
July 03, 1947	Liber 5437, Page 97	July 29, 1947
September 21, 1948	Liber 5677, Page 228	November 3, 1948
May 27, 1998	Liber 4888, Page 1261	June 15, 1998

Legal Description was Established from survey by: Becker & Sica, PC Dated, January 17, 1980

Bearings,Distances, and Area were computed by Keyspan System Surveyor

DB4888/1261
P/O LOT 110 BLOCK 16166

Schedule A

PEEL# 0888/1263

Description of Parcel # 321-B
Rockaway Park, Queens Tax Map
P/O Lots 110, 155, Section 062, Block 16166
situated in
Rockaway Park, New York City
Queens County, State of New York

Beginning at the northwesterly corner of the herein described property line the said true point or place of beginning being more fully described and located as follows:

Beginning at the intersection Rockaway Freeway (easement not shown as a street on the final map of the City of New York) and the southerly side of Beach Channel Drive; Running Thence along the southerly right-of-way line of Beach Channel Drive the following two (2) courses:

1. North 74° 57' 44" East 263.27 feet to a point;
2. North 70° 29' 00" East 425.41 feet to a point;
3. Along the arc of a curve to the right, having a Radius of 1064.54 feet and a Length of 100.44 feet to a point;

Thence along Beach 108th Street, South 13° 01' 20" East 457.84 feet to a point; Thence along Rockaway Freeway (easement not shown as a street on the final map of the City of New York), the following eight (8) courses:

1. South 76° 47' 30" West 226.99 feet to a point;
2. South 76° 47' 30" West 23.14 feet to a point;
3. Along the arc of a curve to the right, having a Radius of 4624.46 feet and a Length of 173.23 feet to a point;
4. South 81° 58' 44" West 102.10 feet to a point;
5. South 83° 12' 23" West 114.87 feet to a point;
6. South 83° 21' 29.3" West 84.47 feet to a point;
7. Along the arc of a curve to the right, having a Radius of 278.41 feet and a Length of 364.62 feet to a point;
8. North 29° 11' 21.2" West 197.49 feet to the true a point or place of beginning;

Containing within said bounds 420,920 square feet and/or 9.847 acres more or less.

Being and intended to be the same premises conveyed to the party of the first part by deeds recorded with the registar of the city of New York, Queens County as follows;

Deed Dated	Recorded	Recorded Date
July 24, 1945	Liber 5048, Page 628	August 18, 1945
July 03, 1947	Liber 5437 Page 97	July 29, 1947

Legal Description was Established from survey by: Becker & Sica, PC Dated: January 17, 1980

Bearings, Distances and Area of Property were computed by LILCO System Surveyor

DB4888/1261
LOT 155 BLOCK 16166

Schedule A

PEEL# 0888/1264

Parcel # 321-B Easement (Substation)

Beginning at the northwesterly corner of the herein described property line the said true point or place of beginning being more fully described and located as follows:

Beginning at the intersection Rockaway Freeway (easement not shown as a street on the final map of the City of New York) and the southerly side of Beach Channel Drive; Running thence along the southerly right-of-way line of Beach Channel Drive the following two (2) courses:

1. North 74° 57' 44" East 263.27 feet to a point;
2. North 70° 29' 00" East 425.41 feet to the true point or place of beginning;

Continues thence along Beach Channel Drive the following two (2) courses:

1. North 70° 29' 00" East 150.14 feet to a point;
2. Along the arc of a curve to the right, having a Radius of 1064.54 feet and a Length of 100.44 feet to a point;

Thence along Beach 108th Street, South 13° 01' 20" East 214.61 feet to a point; Thence through Parcel 321-B, South 76° 58' 40" West 250.00 feet to a point; Thence along the division line of Parcel 321-A to the west and Parcel 321-B to the east, North 13° 01' 20" West 230.00 feet to the true point or place of beginning;

Containing within said bounds 56,012 square feet and/or 1.286 acres more or less.

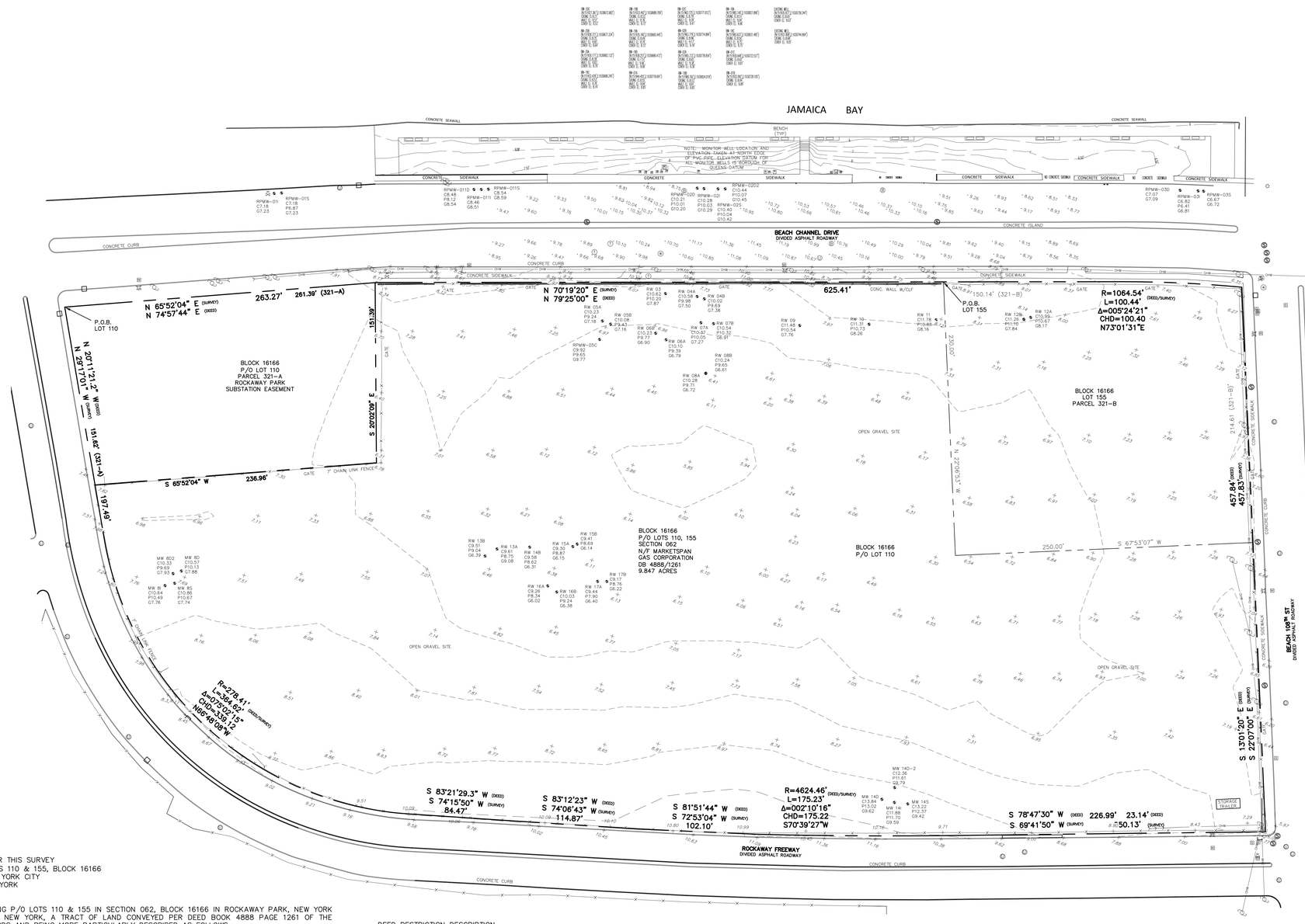
Being and intended to be the same premises conveyed to the party of the first part by deeds recorded with the registar of the city of New York, Queens County as follows;

Deed Dated	Recorded	Recorded Date
July 24, 1945	Liber 5048, Page 628	August 18, 1945
July 03, 1947	Liber 5437 Page 97	July 29, 1947

Legal Description was Established from survey by: Becker & Sica, PC Dated: January 17, 1980

Bearings, Distances and Area of Property were computed by LILCO System Surveyor

RECORDED BY CHICAGO TITLE



VICINITY MAP
NOT TO SCALE

LEGEND

- BOUNDARY LINE
- CHAIN LINK FENCE
- CURB LINE
- DROP CURB
- SIGN
- WATER VALVE
- GAS VALVE
- HYDRANT
- UTILITY POLE
- LIGHT POLE
- DRAINAGE INLET
- MONITORING WELL
- SANITARY MANHOLE
- UNKNOWN MANHOLE
- WATER MANHOLE
- TELECOMMUNICATIONS MANHOLE
- BORE HOLE
- GAS BOX
- WATER BOX

LEGAL DESCRIPTION PER THIS SURVEY
SECTION 062, P/O LOTS 110 & 155, BLOCK 16166
ROCKAWAY PARK, NEW YORK CITY
QUEENS COUNTY, NEW YORK

A TRACT OF LAND BEING P/O LOTS 110 & 155 IN SECTION 062, BLOCK 16166 IN ROCKAWAY PARK, NEW YORK CITY, QUEENS COUNTY, NEW YORK, A TRACT OF LAND CONVEYED PER DEED BOOK 4888 PAGE 1261 OF THE QUEENS COUNTY RECORDS AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE EASTERLY LINE OF ROCKAWAY FREEWAY AND THE SOUTHERLY LINE OF BEACH CHANNEL DRIVE; THENCE,

1. ALONG SAID SOUTHERLY LINE OF BEACH CHANNEL DRIVE NORTH 65° 52' 04" EAST 263.27'; THENCE,
2. CONTINUING ALONG SAID SOUTHERLY LINE THE FOLLOWING TWO COURSES NORTH 70° 19' 20" EAST 625.41'; THENCE,
3. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 1064.54', AN ARC LENGTH OF 100.44', A CENTRAL ANGLE OF 05° 24' 21" WHOSE CHORD BEARS NORTH 73° 01' 31" EAST 100.40' TO THE WESTERLY LINE OF BEACH 108TH STREET; THENCE,
4. ALONG SAID WESTERLY LINE SOUTH 22° 07' 00" EAST 457.83' TO THE NORTHERLY LINE OF THE AFOREMENTIONED ROCKAWAY FREEWAY; THENCE,
5. ALONG SAID NORTHERLY LINE THE FOLLOWING SEVEN COURSES SOUTH 69° 41' 50" WEST 250.13'; THENCE,
6. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 4624.46', AN ARC LENGTH OF 175.23', A CENTRAL ANGLE OF 02° 10' 16" WHOSE CHORD BEARS SOUTH 70° 39' 27" WEST 175.22'; THENCE,
7. SOUTH 72° 53' 04" WEST 102.10'; THENCE,
8. SOUTH 74° 06' 43" WEST 114.87'; THENCE,
9. SOUTH 74° 15' 50" WEST 84.47'; THENCE,
10. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 278.41', AN ARC LENGTH OF 364.62', A CENTRAL ANGLE OF 75° 02' 15" WHOSE CHORD BEARS NORTH 66° 48' 08" WEST 339.12'; THENCE,
11. NORTH 29° 17' 01" WEST 197.49' TO THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT CONTAINING 9.79 ACRES MORE OR LESS.

EXCLUDING FROM ABOVE DESCRIPTION PARCEL DESIGNATED 321-A, EASEMENT TO LIPA, BEING P/O LOT 110 IN SECTION 062, BLOCK 16166 IN ROCKAWAY PARK, NEW YORK CITY, QUEENS COUNTY, NEW YORK, A TRACT OF LAND CONVEYED PER DOCUMENT ID 2004061400453001 OF THE CITY REGISTER OF THE CITY OF NEW YORK AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE EASTERLY LINE OF ROCKAWAY FREEWAY AND THE SOUTHERLY LINE OF BEACH CHANNEL DRIVE; THENCE,

1. ALONG SAID SOUTHERLY LINE OF BEACH CHANNEL DRIVE NORTH 65° 52' 04" EAST 261.39'; THENCE,
2. ALONG THE EASTERLY BOUNDARY LINE SOUTH 20° 02' 09" EAST 151.39'; THENCE,
3. ALONG LAST MENTIONED PROPERTY LINE SOUTH 65° 52' 04" WEST 236.96'; THENCE,
4. ALONG THE EASTERLY LINE SIDE OF ROCKAWAY FREEWAY NORTH 29° 17' 01" WEST 151.62' TO THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT CONTAINING 0.96 ACRES MORE OR LESS.

DEED RESTRICTION DESCRIPTION
NYSDEC SITE ID 152172
SECTION 062, LOTS 110 & 155, BLOCK 16166
ROCKAWAY PARK, NEW YORK CITY
QUEENS COUNTY, NEW YORK

A TRACT OF LAND BEING LOTS 110 & 155 IN SECTION 062, BLOCK 16166 IN ROCKAWAY PARK, NEW YORK CITY, QUEENS COUNTY, NEW YORK, A TRACT OF LAND CONVEYED PER DEED BOOK 4888 PAGE 1261 OF THE QUEENS COUNTY RECORDS AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE INTERSECTION OF THE EASTERLY LINE OF ROCKAWAY FREEWAY AND THE SOUTHERLY LINE OF BEACH CHANNEL DRIVE; THENCE,

1. ALONG SAID SOUTHERLY LINE OF BEACH CHANNEL DRIVE NORTH 65° 52' 04" EAST 263.27'; THENCE,
2. CONTINUING ALONG SAID SOUTHERLY LINE THE FOLLOWING TWO COURSES NORTH 70° 19' 20" EAST 625.41'; THENCE,
3. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 1064.54', AN ARC LENGTH OF 100.44', A CENTRAL ANGLE OF 05° 24' 21" WHOSE CHORD BEARS NORTH 73° 01' 31" EAST 100.40' TO THE WESTERLY LINE OF BEACH 108TH STREET; THENCE,
4. ALONG SAID WESTERLY LINE SOUTH 22° 07' 00" EAST 457.83' TO THE NORTHERLY LINE OF THE AFOREMENTIONED ROCKAWAY FREEWAY; THENCE,
5. ALONG SAID NORTHERLY LINE THE FOLLOWING SEVEN COURSES SOUTH 69° 41' 50" WEST 250.13'; THENCE,
6. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 4624.46', AN ARC LENGTH OF 175.23', A CENTRAL ANGLE OF 02° 10' 16" WHOSE CHORD BEARS SOUTH 70° 39' 27" WEST 175.22'; THENCE,
7. SOUTH 72° 53' 04" WEST 102.10'; THENCE,
8. SOUTH 74° 06' 43" WEST 114.87'; THENCE,
9. SOUTH 74° 15' 50" WEST 84.47'; THENCE,
10. ALONG A CURVE TO THE RIGHT HAVING A RADIUS OF 278.41', AN ARC LENGTH OF 364.62', A CENTRAL ANGLE OF 75° 02' 15" WHOSE CHORD BEARS NORTH 66° 48' 08" WEST 339.12'; THENCE,
11. NORTH 29° 17' 01" WEST 197.49' TO THE POINT OF BEGINNING OF THE HEREIN DESCRIBED TRACT CONTAINING 9.79 ACRES MORE OR LESS.

ENVIRONMENTAL EASEMENT AREA ACCESS

THE DEC OR THEIR AGENT MAY ACCESS THE ENVIRONMENTAL EASEMENT AREA AS SHOWN HEREON THROUGH ANY EXISTING STREET ACCESS OR BUILDING INGRESS/EGRESS ACCESS POINT.

THIS PROPERTY IS SUBJECT TO AN ENVIRONMENTAL EASEMENT BY THE NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION PURSUANT TO THE TITLE 36 OF ARTICLE 71 OF THE NEW YORK ENVIRONMENTAL CONSERVATION LAW. FAILURE TO COMPLY WITH THE SMP.

THE ENGINEERING AND INSTITUTIONAL CONTROLS FOR THIS EASEMENT ARE SET FORTH IN THE SITE MANAGEMENT PLAN (SMP). A COPY OF THE SMP MUST BE OBTAINED BY ANY PARTY WITH INTEREST IN THE PROPERTY. THE SMP CAN BE OBTAINED FROM NYS DEPARTMENT OF ENVIRONMENTAL CONSERVATION, DIVISION OF ENVIRONMENTAL REMEDIATION, SITE CONTROL SECTION, 625 BROADWAY, ALBANY, N.Y. 12233 OR AT "DERWEB@GW.DEC.NY.US".

NOTES

1. THE FOLLOWING INFORMATION WAS UTILIZED IN THE PREPARATION OF THIS SURVEY:
   A. BOUNDARY AND TOPOGRAPHIC SURVEY OF SUBJECT PROPERTY, PREPARED BY NELSON & POPE, DATED 08-30-06.
   B. THE TAX MAPS OF NEW YORK CITY.
   C. VARIOUS DEEDS FOR THE SUBJECT AND ADJACENT PROPERTIES.
   D. FINAL AS-BUILT SURVEY OF THE BARRIER WALL PREPARED BY POSILLICO, DATED 08-10-2016.
2. NEW YORK STATE PLANE COORDINATES (NAD83 – HORIZONTAL, CORS96 AND NAVD88 – VERTICAL, GEOID03) ESTABLISHED FROM RTK GPS OBSERVATIONS.
3. SUBJECT PROPERTY IS DETERMINED TO BE IN ZONE-X (AREAS OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN) PER FEMA MAP NUMBER 3604970379F, REVISED 09-05-07.
4. NO WETLAND DELINEATION AND/OR LOCATION WAS PERFORMED AS A PART OF THIS SURVEY.
5. NO CORNER MARKERS SET PER CONTRACTUAL AGREEMENT.

CERTIFICATION

WE HEREBY CERTIFY TO (1) THE PEOPLE OF THE STATE OF NEW YORK ACTING THROUGH THEIR COMMISSIONER OF THE DEPARTMENT OF ENVIRONMENTAL CONSERVATION THAT THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE CODE OF PRACTICE FOR LAND SURVEYORS ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS.

KENNY L. KENNON, P.L.S.
NEW YORK PROFESSIONAL LAND SURVEYOR LICENSE NO. 50171
DATE: _____

BOUNDARY SURVEY
NATIONAL GRID
SECTION 062 – BLOCK 16166
LOTS 110 & 155
ROCKAWAY PARK, NEW YORK CITY
QUEENS COUNTY, NEW YORK

KSS KENNON SURVEYING SERVICES INC.
5 POWDER HORN DRIVE, SUITE 4
PHONE: 732-564-1818 EMAIL: KSS@KENNONSURVEYING.COM

date	scale	proj. no.	sheet
11-15-16	1" = 40'	2597	1 OF 1

APPENDIX D – MONITORING WELL BORING AND CONSTRUCTION LOGS

Well/Boring Id: PZ-07

Atlantic

Project Name: Rockaway Park Phase I
Project Number: 1691-07-03
Location: West of office building
Date(s): 10/26/95 - 10/26/95
Drilling Contractor: Aquifer Drilling
Drilling Method: 4 1/4 HSA
Logged By: Jane Morgan
Remarks: Overcast, 50's

Elevation: 4.93' | X Coordinate: 976.40
Datum: Queens | Y Coordinate: 1350.96

Blank Casing:
type: PVC dia: 2.00in fm: .0' to: 2.00'

Screens:
type: Slotted size: .020in dia: 2.00in fm: 2.00' to: 12.00'

Annular Fill:
type: Grout fm: .00' to: .90'
type: Bentonite fm: .90' to: 1.50'
type: Sand Pack fm: 1.50' to: 12.00'
type: fm: to:

Split Spoon Sample Depth (ft.)	Blow Per 6"	Recovery	PID	Elevation (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN	Visual Contamination	Odor	Lithology	USCS Code	Depth (ft.)	Well Construction (MP. EL. 4.93)
0-2	3 3 3 3		57 ppm		0.0-1.7' Brown fine-medium Sand, trace gravel and organics.	None	None		FI		
					1.7-2.0' Dense tarry material, some sand, strong tar odor.	Heavy	Strong				
2-4	10 10 10 15		0 ppm		2.0-4.0' Fine-medium Sand, wood chips and gravel, no odor.	None	None				
4-6	13 11 15 18		0 ppm	0	4.0-6.0' Red-brown fine-medium Sand, saturated, no odor.	None	None			5	
					6.0-12.0' Not sampled.						
				-5						10	

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-01I

Date(s): 03/06/00 - 03/06/00

Datum: Mean Sea Level

Elevation: 3.04' | Measuring Point: 7.94'

Completed Depth: 47.00' | Total Depth: 47.50'

Location: Rockaway Park - offsite

Purpose: Monitoring Well, Intermediate

Logged By: Ian Davidson

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 6.50in

Contractor: Delta Well & Pump

Screens:

type: Slotted size: 0.020in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Remarks: Geologic data derived from boring RPSB-02
See log RPSB-02 for sample interval details

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description	Graphic Log	Monitoring Well Screen Zones
5			0.1 ppm	Tan, fine, sandy FILL, loose, dry		
10			165 ppm 80.0 ppm	Black, fine sandy FILL, heavy tar staining, naphtha odor, shale fragments, wet, med dense		
15			8.0 ppm 1.8 ppm	Gray, fine SAND w/band of soft gray CLAY, light tar staining, naphtha odor, wet		
20			1.0 ppm 0.9 ppm	Gray, med-coarse SAND, slight naphtha odor, stains, med dense, shells, wet		
25			0.9 ppm 2.0 ppm	Gray, fine-coarse SAND, naphtha/hydrocarbon odor, shells, wet, med dense		

Screen interval depths illustrated for wells RPMW-01S and RPMW-01I

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-01I
Location: Rockaway Park - offsite	Date(s): 03/06/00 - 03/06/00
Purpose: Monitoring Well, Intermediate	Total Depth: 47.50'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
			6.8 ppm 8.3 ppm	Gray, fine SAND, trace stain, naphtha odor, crushed shells, med dense, wet		
5			19.0 ppm	Gray, fine SAND, slight naphtha odor, moist, med dense		
			18.5 ppm			
10			2.4 ppm 1.8 ppm	Gray, med-fine SAND, slight naphtha odor, wet, med dense		
45				Base of well boring- 47.5'		
50						
55						
60						
65						

Screen interval depths illustrated for wells RPMW-01S and RPMW-01I

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-02D

Date(s): 03/07/00 - 03/07/00

Datum: Mean Sea Level

Elevation: 6.17' | Measuring Point: 11.12'

Completed Depth: 76.00' | Total Depth: 76.00'

Location: Rockaway Park - offsite

Purpose: Monitoring Well, Deep

Logged By: Jeff Diamond

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 6.00in

Contractor: Delta Well & Pump

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'
type: Slotted size: 0.010in dia: 2.00in fm: 64.00' to: 74.00'

Remarks: Geologic data derived from boring RPSB-03
See log RPSB-03 for recovery/sample intervals

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
			0.0 ppm	Gray/brown, mix top soil, FILL, w/concrete clinker, dry
			0.0 ppm	
			0.0 ppm	Brown, med-coarse sandy FILL w/concrete, clinker, coal tar, dry
5			0.0 ppm	
			0.0 ppm	Tan-orange, fine-med SAND, iron oxide staining, wet loose
10			0.0 ppm	Orange-green-black, fine SAND, iron oxide/black staining, wet, loose
			0.0 ppm	Gray, fine SAND, slight naphtha odor, crushed shells, wet, loose
			0.0 ppm	Same as above
15				No Recovery (16-18')
				No Recovery (18-20')
20			0.0 ppm	Gray, fine SAND, slight naphtha odor, crushed shells, wet, loose
				No Recovery (22-24')
			0.0 ppm	Gray, fine SAND, sulfur/organic odor, crushed shells, wet, medium dense
25			0.4 ppm	Gray, fine SAND, organic odor, medium dense, wet
			32.0 ppm	Gray, CLAY to fine SAND, light stain, tar odor, medium dense, wet

Graphic Log / Monitoring Well Screen Zones

Screen interval depths illustrated for wells RPMW-02S, RPMW-02I and RPMW-02D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-02D
Location: Rockaway Park – offsite	Date(s): 03/07/00 – 03/07/00
Purpose: Monitoring Well, Deep	Total Depth: 76.00'

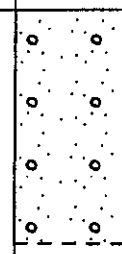
Depth (ft)	Recovery	Sample Interval	PID	Material Description
			38.0 ppm	Black, fine SAND w/CLAY bands, heavy tar stain, organic/naphtha odor
			10.9 ppm	wood chunks, blue sheen, crushed shells
			21.5 ppm	Same as above
			13.0 ppm	Gray, fine SAND, naphtha odor, crushed shells, wet, loose
5			13.5 ppm	
			9.0 ppm	Gray, fine SAND, naphtha odor, loose, wet
			13.5 ppm	
			13.5 ppm	Same as above, but medium dense
			9.2 ppm	
10				
			50.0 ppm	Same as above
			21.0 ppm	
15			144.0 ppm	Gray, fine SAND, strong naphtha/organic odor, moist, medium dense
			64.0 ppm	
20			175.0 ppm	Same as above, w/crushed shells
			127.0 ppm	
25			24.0 ppm	Same as above
			21.3 ppm	
30				
35				

Graphic Log

Monitoring Well Screen Zones

Screen interval depths illustrated for wells RPMW-02S, RPMW-02I and RPMW-02D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-02D
Location: Rockaway Park – offsite	Date(s): 03/07/00 – 03/07/00
Purpose: Monitoring Well, Deep	Total Depth: 76.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
75				Base of well boring– 76 ft.		
80						
85						
90						
95						
100						
105						

Screen interval depths illustrated for wells RPMW-02S, RPMW-02I and RPMW-02D

Site Id: RPMW-02D2

Client: Keyspan Energy, Inc.			
Project Number: 982482	Project Name: Rockaway Park	Date Started: 08/29/02	Date Completed: 08/29/02
Remarks:		Ground Elevation: 11.72'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 107.00'
		Drilling Method: Sonic Drilling	
		Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Vis. Signs of Contamination	Elevation (ft)	Well Construction
0-7		40			0'-6' Asphalt and concrete road with gravel subgrade, no odors or visual impacts.			10	
			2.9 ppm		6'-7' Light brown, FINE to MED SAND, trace small gravel, dry, loose, non-cohesive, no odors or visual impacts.				
7-17		60			7'-16' Brown, FINE to MED SAND 7'-9' wet, loose, non-cohesive 9'-11' urban fill, tile and brick fragments, med gravel 11'-16' former road surface, concrete with asphalt and gravel subgrade, no odors or visual impacts.			0	
				10					

Legend: Physical Observations

None | Blebs, Globs, Lenses, Grain Coating, Sheens | Stain | Tar Saturated | Solid Tar

Site Id: RPMW-02D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.
			3.9 ppm		16'-17' Brown to grey MED SAND, trace coke, some small gravel, wet, loose, non-cohesive, slight petroleum odor, no visual impacts.
17-27		70			17'-23' Grey, FINE to MED SAND, wet, loose, non-cohesive, tar blebs from 19'-20' patchy sheen from 20'-22.5'. 1/4" band of tar saturated MED SAND at 22.5' faint to mod tar odor.
			61.2 ppm	20	
			242 ppm		23'-24' Black, SILTY CLAY, wet, dense, pliable, no visual impacts, slight purifier odor.
			126 ppm		24'-27' Light Grey, FINE SAND, wet, loose, non-cohesive, no visual impacts, faint naph odor.
27-37		100	14.2 ppm		27'-35' Gray, FINE to MED SAND, wet, loose, non-cohesive, bands of medium to coarse sand, small gravel and shell fragments at 29.5'-30' and 32'-35'.

Lithology / Physical Observations

Elevation (ft): -10

Well Construction

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-02D2

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	

Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.
					35'-36' Brown tar saturated 3" bands of MED to COARSE SAND with 2" bands of FINE SAND separating, some shell fragments, some small gravel, faint to moderate tar odor.
			671 ppm		
			18.0 ppm		36'-37' Grey, FINE SAND, wet, loose, non-cohesive, faint naphthalene odor, no visual impacts.
37-47		100	190 ppm		37'-47' Grey, FINE SAND, trace med sand, wet, loose, non-cohesive, strong sulfur odor, no visual impacts.
				40	

Lithology / Physical Observations

Elevation (ft): -20, -30

Well Construction

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-02D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	

Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
47-57		96	374 ppm		47'-57' Grey, FINE SAND, trace med sand, wet, loose, non-cohesive 47'-51' 3" band of tar saturated med SAND at 47' and 51' thin 1/4" to 1/2" veins of brown tar stained sand running vertically through interval, mod to strong tar odor. 51'-55' No visual impacts, strong sulfur odor 55'-57' two thin 1/4" bands of tar saturated material at 56', strong sulfur odor.				
				50					
			83.5 ppm					-40	
			42.6 ppm						
57-67		95	32.5 ppm		57'-62' Grey, FINE SAND, trace med sand, trace shell fragments, strong sulfur odor, wet, loose, non-cohesive				

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-02D2

Client: Keyspan Energy, Inc.

Project Number: 982482 | Project Name: Rockaway Park

Remarks:

Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
			185 ppm		62'-66' Grey, FINE to MED SAND, wet, loose, non-cohesive, 1/2" to 3" bands of tar saturated med to coarse sand, some small pebbles, mod tar odor			-50	
					66'-67' Brown, FINE SAND, wet, loose, non-cohesive, faint sulfur odor, no visual impacts.				
67-77		100	11.7 ppm		67'-77' Brown FINE SAND, wet, loose, non-cohesive, no odors or visual impacts.				
				70					
			14.5 ppm		71'-73' Band of Black FINE SAND, wet, loose, non-cohesive, mod sulfur odor, no visual impacts. Black sand is slightly coarser than brown sand above and below.			-60	
			12.2 ppm		73'-77' Brown, FINE SAND, wet, loose, non-cohesive no odors or visual impacts.				

Legend: Physical Observations

None | Blebs, Globs, Lenses, Grain Coating, Sheens | Stain | Tar Saturated | Solid Tar

Site Id: RPMW-02D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	

Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
77-87		100	8.2 ppm	80	77'-87' Dark grey to brown, FINE SAND, wet, loose, non-cohesive, no odors or visual impacts.			-70	
87-97		100	5.0 ppm		87'-97' Brown, FINE SAND, wet, loose, non-cohesive, no odors or visual impacts.				

Legend: Physical Observations

None | Blebs, Globs, Lenses, Grain Coating, Sheens | Stain | Tar Saturated | Solid Tar

Site Id: RPMW-02D2

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
97-107		100	1.9 ppm	100	97'-107' As Above, no odors or visual impacts.			-80 -90	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-02D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	

Date Started: 08/29/02	Date Completed: 08/29/02
Ground Elevation: 11.72'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
					END OF BORING AT 107'.				
				110				-100	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-03D

Date(s): 03/06/00 - 03/06/00

Datum: Mean Sea Level

Elevation: 2.95' | Measuring Point: 8.08'

Completed Depth: 77.00' | Total Depth: 78.00'

Location: Rockaway Park - offsite

Purpose: Monitoring Well, Deep

Logged By: J Diamond/I. Da

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 6.50in

Contractor: Delta Well & Pump

Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'
type: Slotted size: 0.010in dia: 2.00in fm: 65.00' to: 75.00'

Remarks: Geologic data derived from boring RPSB-05
See log RPSB-05 for sample intervals/recovery

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
			ppm	
			0.0 ppm	Brown-tan, med-fine sandy FILL, organics, clinker, dry, loose
			4.0 ppm	
5			3.2 ppm	Brown-light tan, fine-med sandy FILL, iron oxide stain, clinker, shells, loose, moist
			4.2 ppm	
			8.6 ppm	
				No recovery (8-10')
10			1.5 ppm	Gray, fine SAND, shells, wet, medium dense
				No recovery (12-14')
			0.2 ppm	Gray, fine SAND, naphtha odor, wet, medium dense
15			1.6 ppm	Same as above, no odor
			0.2 ppm	Same as above
20			0.2 ppm	Black-gray, fine SAND, organic/naphtha odor, medium dense
			0.2 ppm	
			40.0 ppm	Same as above
			15.2 ppm	Same as above, but loose
25			34.0 ppm	
			18.0 ppm	Gray, fine-coarse SAND, naphtha odor, shells, wet, medium dense
			28.0 ppm	
				Interval Skipped

Graphic Log / Monitoring Well Screen Zones

Screen interval depths illustrated for RPMW-03S, RPMW-03I and RPMW-03D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-03D
Location: Rockaway Park - offsite	Date(s): 03/06/00 - 03/06/00
Purpose: Monitoring Well, Deep	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
			1.8 ppm	Gray, fine SAND, naphtha odor, moist, dense		
			0.8 ppm			
			5.4 ppm	Gray, medium SAND, moist, loose		
			2.3 ppm			
			25.0 ppm	Same as above, w/heavy sulfur/naphtha odor		
35			32.0 ppm			
			159.0 ppm	Same as above, but medium dense		
			60.0 ppm			
			110.0 ppm	Same as above		
			111.0 ppm			
40						
			110.0 ppm	Same as above, but fine sand, loose		
45			130.0 ppm			
			30.0 ppm	Same as above		
50			7.6 ppm			
			0.0 ppm	Gray, med SAND, slight organic odor, shells, wet, loose		
55						
			0.0 ppm	Brown, fine SAND, moist, dense		
60						
			0.0 ppm	Brown, fine SAND, wet, dense		
65						

Screen interval depths illustrated for RPMW-03S, RPMW-03I and RPMW-03D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-03D
Location: Rockaway Park - offsite	Date(s): 03/06/00 - 03/06/00
Purpose: Monitoring Well, Deep	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
75				Base of well boring- 78 ft.		
80						
85						
90						
95						
100						
105						

Screen interval depths illustrated for RPMW-03S, RPMW-03I and RPMW-03D

Dvirka and Bartilucci
CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-04I

Date(s): 02/07/00 - 02/07/00

Datum: Mean Sea Level

Elevation: 2.87' | Measuring Point: 11.21'

Completed Depth: 47.00' | Total Depth: 48.00'

Location: Rockaway Park

Purpose: Monitoring Well, Intermediate

Logged By: Jeff Diamond

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 8.25in

Contractor: LAWES

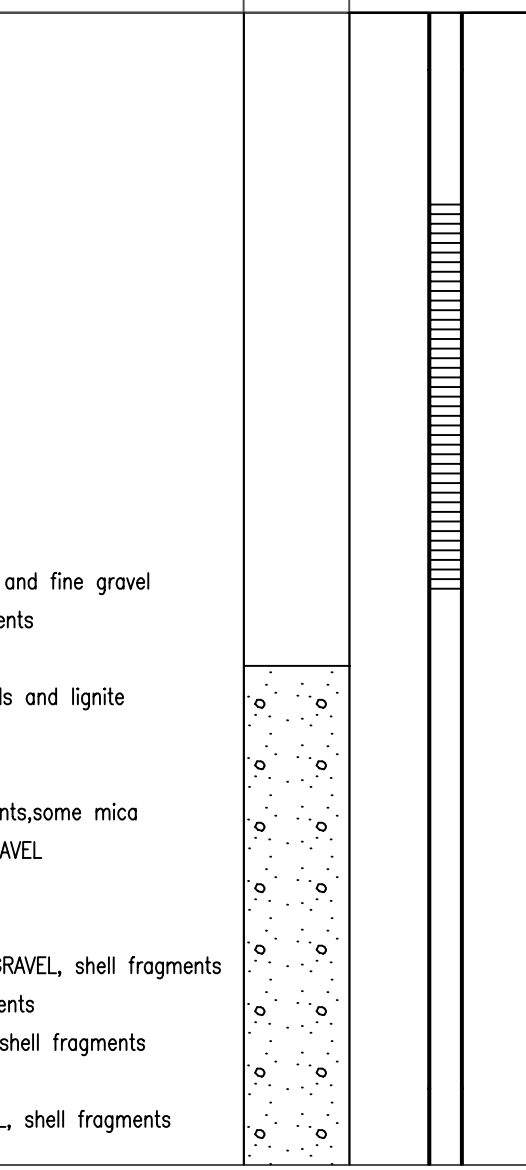
Screens:
type: Slotted size: 0.020in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'

Remarks: Geologic data derived from boring RPSB-07
See log for RPSB-07 for recovery/sample intervals

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
				FILL (upper 15' not sampled)
15			0.0 ppm	Medium-dark gray, med-coarse, sandy FILL w/some mica and fine gravel
			0.0 ppm	Gray-black clay lense in sandy FILL w/clinker, shell fragments
			0.0 ppm	Medium gray, med-coarse SAND, shell fragments
				Medium gray, med-coarse SAND, w/some mica, trace shells and lignite
			0.0 ppm	Medium dark gray, med-fine SAND, some mica
20			0.0 ppm	Med. gray, coarse-v.coarse SAND w/f.GRAVEL, shell fragments,some mica
				Same as above, medium-light gray, w/subrounded fine GRAVEL
			0.0 ppm	Same as above, medium-dark gray
25			0.0 ppm	Med-lt gray, v.coarse-coarse SAND w/fine-med rounded GRAVEL, shell fragments
				Med gray, fine-coarse, micaceous SAND, trace shell fragments
			0.0 ppm	Med gray, coarse-v.coarse SAND w/rounded med GRAVEL, shell fragments
				Med-light gray, coarse-medium SAND
			0.0 ppm	Med gray, coarse-med SAND w/mica, rounded med GRAVEL, shell fragments

Graphic Log

Monitoring Well Screen Zones



Screen interval depths illustrated for wells RPMW-04S and RPMW-04I

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-04I
Location: Rockaway Park	Date(s): 02/07/00 - 02/07/00
Purpose: Monitoring Well, Intermediate	Total Depth: 48.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
			0.0 ppm	Med gray, coarse-med SAND w/some mica, fine GRAVEL, shell fragments		
			0.0 ppm	Med gray, medium-v. coarse SAND, w/rounded med GRAVEL, some mica, tr. shell fragments		
35			0.0 ppm	Med gray, med-coarse SAND w/some fine GRAVEL, shell fragments		
				Med-dark gray, med-fine, micaceous SAND		
			0.0 ppm	Same as above		
			0.0 ppm	Medium dark gray, medium-v.coarse. micaceous SAND		
40						
45						
				Base of well boring - 48 ft.		
50						
55						
60						
65						

Screen interval depths illustrated for wells RPMW-04S and RPMW-04I

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-11D

Date(s): 03/02/00 - 03/02/00

Datum: Mean Sea Level

Elevation: 4.53' | Measuring Point: 9.57'

Completed Depth: 77.00' | Total Depth: 78.00'

Location: Rockaway Park - offsite

Purpose: Domestic Well

Logged By: Jeff Diamond

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 6.50in

Contractor: Delta Well & Pump

Screens:

type: Slotted size: 0.010in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.010in dia: 2.00in fm: 35.00' to: 45.00'
type: Slotted size: 0.010in dia: 2.00in fm: 65.00' to: 75.00'

Remarks: Geologic data derived from boring RPSB-02A
See log RPSB-02A for recovery/sample details

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description	Graphic Log	Monitoring Well Screen Zones
5			0.0 ppm	Brown-tan, fine sandy FILL, dry, med dense		
10			33.1 ppm	Black, fine sandy FILL, tar stains, naphtha odor, wet, loose		
15			33.1 ppm	Same as above		
20			50.3 ppm	Black, fine sandy FILL, naphtha odor, tar stained, clinker, moist, dense		
25			13.7 ppm	Same as above		

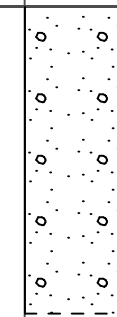
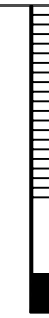
Screen zones illustrated for RPMW-11S, RPMW-11I and RPMW-11D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-11D
Location: Rockaway Park – offsite	Date(s): 03/02/00 – 03/02/00
Purpose: Domestic Well	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
			3.5 ppm	Gray, medium SAND, w/shell fragments, tar staining, naphtha odor, moist, dense		
35			19.2 ppm	Gray, med-fine SAND, naphtha odor, moist, loose		
40			55.0 ppm	Same as above		
45			34.7 ppm	Same as above		
50			12.5 ppm	Same as above		
55			0.0 ppm	Gray, med-fine SAND, wet, w/shell fragments		
60						
65						

Screen zones illustrated for RPMW-11S, RPMW-11I and RPMW-11D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-11D
Location: Rockaway Park – offsite	Date(s): 03/02/00 – 03/02/00
Purpose: Domestic Well	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
75				Base of well boring – 78'		
80						
85						
90						
95						
100						
105						

Screen zones illustrated for RPMW-11S, RPMW-11I and RPMW-11D

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-14D

Date(s): 03/13/00 - 03/13/00

Datum: Mean Sea Level

Elevation: 3.65' | Measuring Point: 0.00'

Completed Depth: 78.00' | Total Depth: 78.00'

Location: Rockaway

Purpose: Monitoring Well, Deep

Logged By:

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 6.00in

Contractor: Delta Well & Pump

Screens:

type: Slotted size: 0.020in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'
type: Slotted size: 0.020in dia: 2.00in fm: 66.00' to: 76.00'

Remarks: Geologic material/sample/recovery data derived from boring RPSB-52

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
				No recovery (2-4')
				No recovery (4-6')
5			700 ppm 600 ppm 800 ppm 1500 ppm	Dark gray, fine-coarse SAND, loose, wet, heavy hydrocarbon odor
10			110 ppm 50.0 ppm 25.0 ppm	Dark gray-black, fine SAND, loose, wet, heavy hydrocarbon odor
15			30.0 ppm 85.0 ppm 75.0 ppm 15.0 ppm	Black, fine-coarse SAND, loose, wet, heavy hydrocarbon odor
20			20.0 ppm 6.5 ppm 15.0 ppm	Black, fine-med SAND, loose, wet, hydrocarbon odor
25			0.0 ppm	Grayish-black, fine-med SAND, med dense, wet

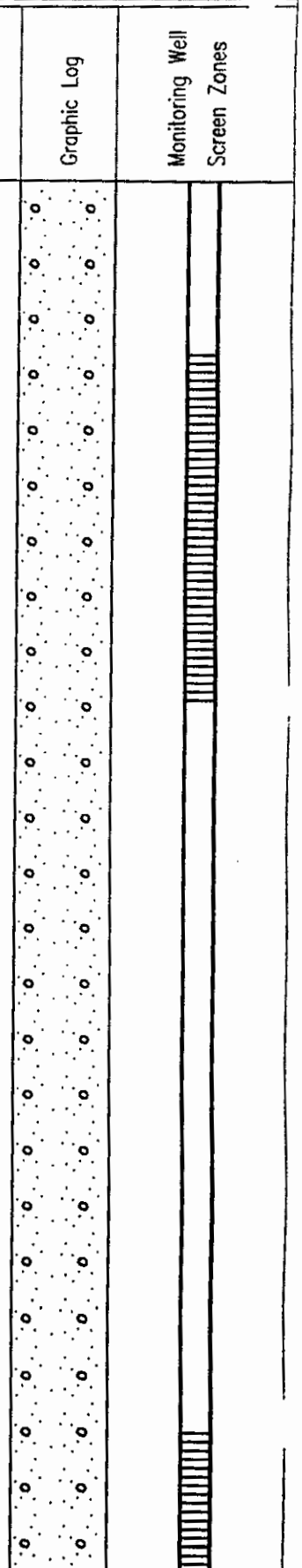
Graphic Log

Monitoring Well Screen Zones

Screen interval depths illustrated for wells RPMW-14S, RPMW-14I and RPMW-14D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-14D
Location: Rockaway	Date(s): 03/13/00 - 03/13/00
Purpose: Monitoring Well, Deep	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description
			0.0 ppm 1.4 ppm	Gray, fine, micaceous SAND, med dense, wet
3			0.0 ppm	Same as above
4				No recovery (40-42')
			0.0 ppm	Gray, fine SAND, med dense, wet
6				
9				
15				
18				



Screen interval depths illustrated for wells RPMW-14S, RPMW-14I and RPMW-14D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-14D
Location: Rockaway	Date(s): 03/13/00 - 03/13/00
Purpose: Monitoring Well, Deep	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
75				Base of well boring - 78'		
80						
85						
90						
95						
100						
105						

Screen interval depths illustrated for wells RPMW-14S, RPMW-14I and RPMW-14D

Site Id: RPMW-14D2

GEI Consultants, Inc

Client: Keyspan Energy, Inc.			
Project Number: 982482	Project Name: Rockaway Park	Date Started: 08/19/02	Date Completed: 08/20/02
Remarks:		Ground Elevation: 9.09'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 107.00'
		Drilling Method: Sonic Drilling	
		Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.
0-7		50			0'-1' Concrete pad, gravel
			10.7 ppm		1'-7' Black, MEDIUM to COARSE SAND, some fine sand, little small gravel, no odors or visible impacts
7-17		100			7'-10' Black, MEDIUM to COARSE SAND, some fine sand, little small gravel, no odors or visible impacts
			853 ppm	10	10'-14' Black to brown, FINE SAND, wet loose, non-cohesive, bands of light brown and black stained soil, moderate fuel odor.
			578 ppm		14'-17' Dark gray, FINE SAND, wet loose, non-cohesive, faint naphthalene odor, no visual contamination.

Lithology / Vis. Signs of Contamination

Elevation (ft): 0

Well Construction: MP. EL. 0.00

Legend: Physical Observations

None | Blebs, Globs, Lenses, Grain Coating, Sheens | Stain | Tar Saturated | Solid Tar

Site Id: RPMW-14D2

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	

Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
17-27		95	2.7 ppm	20	17'-27' Dark grey, FINE TO MEDIUM SAND, trace shell fragments, wet, loose, non-cohesive, 2" band of shell fragments, medium to coarse sand, and small gravel at 23'			-10	
27-37		93	2.0 ppm		27'-37' Dark grey, FINE SAND, trace medium sand, trace shell fragments, wet, loose, non-cohesive, no odors. 3" band of shell fragments, medium sand and small gravel at 29', no odors. 1" band of brown organic material at 31'6", strong organic odor, no visual impacts 27-37			-20	

Legend: Physical Observations

None | Blebs, Globs, Lenses, Grain Coating, Sheens | Stain | Tar Saturated | Solid Tar

Site Id: RPMW-14D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
37-47		93	2.1 ppm	40	37'-47' Grey, FINE SAND, wet, loose, non-cohesive, no odors, or visual impacts.			-30	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-14D2

GEI Consultants, Inc

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
47-57		87	6.6 ppm	50	47'-57' Grey, FINE SAND, wet, loose, non-cohesive, no odors, or visual impacts.			-40	
57-67		100	2.8 ppm		57'-67' Grey, FINE SAND, trace medium sand, trace shell fragments, wet, loose, non-cohesive. 12" band of medium sand, some shell fragments, trace coarse sand at 65'6"-66'6". No odors or visual impacts.			-50	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-14D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
67-77		90	6.6 ppm	70	67'-77' Grey, FINE SAND, wet, loose, non-cohesive, no visual impacts or odors.			-60	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-14D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	

Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
77-87		100	0.3 ppm	80	77'-87' Brown, FINE SAND, trace medium sand, wet, loose, non-cohesive, thin veins of darker brown, medium sand, running vertically from 78'-82', no odors or visual contamination.			-70	
87-97		95	0.4 ppm		87'-97' Reddish brown, FINE SAND, wet, loose, non-cohesive, no odors or visual impacts.			-80	

Legend: Physical Observations

None | Blebs, Globs, Lenses, Grain Coating, Sheens | Stain | Tar Saturated | Solid Tar

Site Id: RPMW-14D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
97-107		100	0.6 ppm	100	97'-107' Reddish brown, FINE SAND, wet, loose, non-cohesive, no odors or visual impacts			-90	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

Site Id: RPMW-14D2

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482	Project Name: Rockaway Park
Remarks:	
Date Started: 08/19/02	Date Completed: 08/20/02
Ground Elevation: 9.09'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 107.00'
Drilling Method: Sonic Drilling	
Logged By: Matt O'Neil	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Lithology	Physical Observations	Elevation (ft)	Well Construction
					END OF BORING AT 107'.			-100 -110	

Legend: Physical Observations

- None
- Blebs, Globs, Lenses, Grain Coating, Sheens
- Stain
- Tar Saturated
- Solid Tar

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

CLIENT: National Grid
PROJECT NAME: Rockaway Park
CITY/STATE: Rockaway, NY
GEI PROJECT NUMBER: 093150-1-1104

BORING LOG
PAGE 1 of 2
RPMW-16 IR

GROUND SURFACE ELEVATION (FT): _____ **LOCATION:** _____
NORTHING: _____ **EASTING:** _____ **TOTAL DEPTH (FT):** 45.00
DRILLED BY: Zebra Environmental **DATUM VERT. / HORZ.:** _____
LOGGED BY: Chris Morris **DATE START / END:** 1/15/2010 - 1/15/2010
DRILLING DETAILS: Geoprobe
WATER LEVEL DEPTHS (FT): ▽ 7.00 1/15/2010

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC IN.	PID (ppm)	STRATA	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION
0		5.0						0 - 2 SILTY SAND (SM); ~60% sand, fine to medium, ~30% fines, ~10% gravel, fine to coarse; brown, FILL.
								2 - 2.7 SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; dry, light brown.
								2.7 - 4 NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine to coarse, ~10% fines; brown.
								4 - 5 SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; dark brown / black, FILL.
5	S-1	5.0	27	0.0				5 - 7 NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; light brown.
				0.0				
▽				0.0				7 - 8.5 NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; wet, light brown.
				0.0				8.5 - 9.1 FILL, fragments of brick, wood and pieces of carpet.
				0.0		CrLO		9.1 - 9.4 FILL, broken cobbles.
10	S-2	5.0	46	0.0		OLO	Sample collected 10-15'	9.4 - 10 NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine, ~10% fines; slight creosote-like odor, black, FILL, wood fragments.
				0.0				10 - 11.3 SILTY SAND (SM); ~70% sand, fine to medium, ~20% fines, ~10% gravel; moderate organic-like odor, wet, black, soft.
				0.0				11.3 - 13.5 NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; wet, light brown / red brown.
				0.0				13.5 - 15 WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~10% gravel, fine; wet, light brown.
15	S-3	5.0	32	0.2				15 - 18.1 NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; wet, light brown.
				0.2				
				0.2				18.1 - 19.7 NARROWLY GRADED SAND (SP); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, light brown.
				0.2				
				0.2				19.7 - 20 NARROWLY GRADED SAND (SP); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, light brown, shell fragments.
20	S-4	5.0	35	0.0				20 - 24.4 NARROWLY GRADED SAND (SP); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, light brown to grayish, trace shell fragments.
				0.0				
				0.0				
				0.0				

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
MLO = MUSTY LIKE ODOR

ENVIRONMENTAL BORING LOG RPMW-16.GPJ GEI CONSULTANTS.GDT 3/29/10

GEI Consultants

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

CLIENT: National Grid
PROJECT NAME: Rockaway Park
CITY/STATE: Rockaway, NY
GEI PROJECT NUMBER: 093150-1-1104

BORING LOG

RPMW-16 IR

DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN FT.	REC IN.	PID (ppm)	STRATA	ODOR	ANALYZED SAMPLE ID	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
				0.0					
25	S-5	5.0	34	0.0				24.4 - 25 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown to gray, trace shell fragments.	
				0.0				25 - 25.3 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown to gray, trace shell fragments.	
				0.0				25.3 - 25.7 WIDELY GRADED SAND WITH GRAVEL (SW); ~80% sand, fine to coarse, ~15% gravel, fine, ~5% fines; wet, light brown to gray.	
				0.0				25.7 - 30 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown to gray, trace shell fragments.	
				0.0					
30	S-6	5.0	20	0.0				30 - 33.4 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light brown to gray, trace shell fragments.	
				0.0					
				0.0					
				0.0					
				0.0				33.4 - 35 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light gray, trace shell fragments.	
35	S-7			0.0				35 - 37.8 NARROWLY GRADED SAND (SP); ~95% sand, fine to coarse, ~5% gravel, fine, ~5% fines; wet, light gray.	
				0.0					
				0.0					
				0.0				37.8 - 40 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light gray.	
				0.0					
40	S-8	5.0	23	0.0			Sample collected 40-45'	40 - 45 NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; wet, light gray.	
				0.0					
				0.0					
				0.0					
				0.0					
45								Bottom of borehole at 45.0 feet.	

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
MLO = MUSTY LIKE ODOR

Dvirka and Bartilucci CONSULTING ENGINEERS
A DIVISION OF WILLIAM F. COSULICH ASSOCIATES, P.C.

Site Id: RPMW-17D

Date(s): 02/24/00 - 02/24/00

Datum: Mean Sea Level

Elevation: 2.46' | Measuring Point: 7.61'

Completed Depth: 78.00' | Total Depth: 78.00'

Location: Rockaway Park - offsite

Purpose: Monitoring Well, Deep

Logged By: J. Schafer

Drilling Method: 4.25" I.D. Hollow Stem Auger

Borehole Dia.: 6.50in

Contractor: LAWES

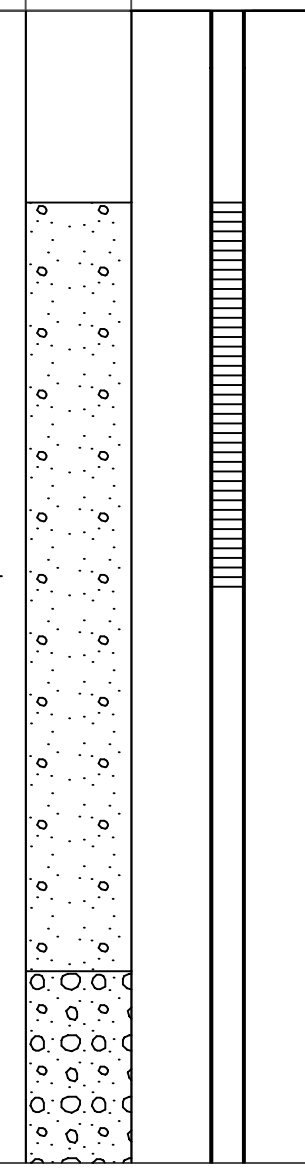
Screens:

type: Slotted size: 0.020in dia: 2.00in fm: 5.00' to: 15.00'
type: Slotted size: 0.020in dia: 2.00in fm: 35.00' to: 45.00'
type: Slotted size: 0.020in dia: 2.00in fm: 65.00' to: 75.00'

Remarks: Geologic/sample data derived from log for boring RPSB-61

Depth (ft)	Recovery	Sample Interval	Vapor	Material Description
5			20.5 ppm 25.7 ppm 31.3 ppm	Tan-gray, fine-med SAND, wet at 6', loose, sewage odor
10			200 ppm 2000+ ppm 2000+ ppm	Gray, fine-med SAND, med dense, wet, heavy solvent odor
15			60.0 ppm 150 ppm 70.0 ppm	Dark gray-black, fine-coarse SAND, w/some GRAVEL & shells, solvent odor
20			35.0 ppm 19.0 ppm 27.0 ppm	Same as above
25			11.7 ppm 28.5 ppm 24.9 ppm	Gray, fine-coarse SAND & GRAVEL, solvent odor

Graphic Log / Monitoring Well Screen Zones



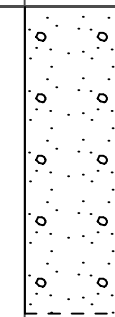
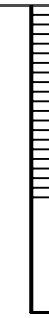
Screen interval depths illustrated for wells RPMW-17S, RPMW-17I and RPMW-17D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-17D
Location: Rockaway Park - offsite	Date(s): 02/24/00 - 02/24/00
Purpose: Monitoring Well, Deep	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
			30.0 ppm 50.0 ppm	Gray, fine SAND, wet, med dense, slight solvent odor		
35			48.2 ppm 50.1 ppm	Gray, fine SAND, dense, wet, no odor		
40			7.3 ppm 11.9 ppm	Same as above		
45			15.5 ppm 13.2 ppm	Gray, fine SAND, wet, med dense, w/shells		
50			17.5 ppm	Gray, fine-med SAND, wet, med dense		
55			8.7 ppm 9.1 ppm	Same as above		
60						
65						

Screen interval depths illustrated for wells RPMW-17S, RPMW-17I and RPMW-17D

Consulting Firm: Dvirka & Bartilucci	Site Id: RPMW-17D
Location: Rockaway Park – offsite	Date(s): 02/24/00 – 02/24/00
Purpose: Monitoring Well, Deep	Total Depth: 78.00'

Depth (ft)	Recovery	Sample Interval	PID	Material Description	Graphic Log	Monitoring Well Screen Zones
75				Base of well boring – 78 ft.		
80						
85						
90						
95						
100						
105						

Screen interval depths illustrated for wells RPMW-17S, RPMW-17I and RPMW-17D

Site Id: RPMW-19S

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.			
Project Number: 982482-9	Project Name: Rockaway Park	Date Started: 12/02/03	Date Completed: 12/02/03
Remarks:		Ground Elevation: 8.40'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 15.00'
		Drilling Method: Geoprobe	
		Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology	Vis. Signs of Contamination	Odors	Elevation (ft.)	Well Construction
0-5		100			0.0-3.0: RPMW-19S cleared by hand for utility concerns. General description of material is brown/tan, dry, fine SAND, trace fine gravel, non-cohesive, no odor, no visual contamination. (SP)						
					3.0-6.5: Tan, dry, fine SAND, non-cohesive, moderately stiff, no odor, no visual contamination. (SP)						
5-10		80									
			0.3 ppm		6.5-8.8: Tan and orange, fine SAND, non-cohesive, slightly stiff, no odor, no visual contamination. Vein of platy mica minerals at 7.8'. (SP)				NONE		
						8.0-9.0				0	
			0.2 ppm		8.8-10.0: Gray, dry, fine SAND, non-cohesive, moderately stiff, no odor, no visual contamination. (SP)						
10-15		72		10	10.0-11.0: Orange/tan, dry, fine SAND. (SP)						
			0.2 ppm		11.0-13.0: Tan and gray, mottled, wet, fine SAND, semi-cohesive, moderately stiff, no odor, no visual contamination. (SP)						
			0.2 ppm		RPMW-19S WELL CONSTRUCTION: 0.0-2.0 Bentonite chips 2.0-12.3: Sand 0.0-2.3: Riser 2.3-12.3: Screen						
			0.2 ppm		13.0-15.0: Gray, wet, fine SAND, semi-cohesive, moderately stiff, no odor, no visual contamination. (SP)						
					15.0: End of boring.						

Legend: Physical Observations

None | Sheen | Stain | Heavy

Site Id: RPMW-20I

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.			
Project Number: 982482-9	Project Name: Rockaway Park	Date Started: 12/02/03	Date Completed: 12/02/03
Remarks:		Ground Elevation: 8.78'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 30.00'
		Drilling Method: Geoprobe	
		Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology / Vis. Signs of Contamination	Odors	Elevation (ft.)	Well Construction
					0.0-3.0: RPMW-20I cleared by hand for utility concerns.					
3-5		100	0.0 ppm		3.0-5.0: Tan, slightly mottled, dry, fine SAND, little shell fragments, non-cohesive, slightly stiff, no odor, no visual contamination. (SP)					
			0.0 ppm							
5-10		86			5.0-10.0: Tan, slightly mottled, dry, fine SAND, non-cohesive, slightly stiff, becomes wet at 8.4',no odor, no visual contamination. (SP)			NONE		
						7.0-8.0				
									0	
10-15		100		10	10.0-10.7: SAA					
			0.0 ppm		10.7-15.0: Gray, wet, fine SAND, semi-cohesive, moderately stiff, sulfur odor, no visual contamination. (SP)			MODERATE		
			0.0 ppm							
			0.0 ppm							

Legend: Physical Observations

None | Sheen | Stain | Heavy

Site Id: RPMW-20I

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482-9	Project Name: Rockaway Park
Remarks:	
Date Started: 12/02/03	Date Completed: 12/02/03
Ground Elevation: 8.78'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 30.00'
Drilling Method: Geoprobe	
Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology	Physical Observations	Odors	Elevation (ft)	Well Construction
15-20		92	0.0 ppm		15.0-17.5: SAA						
			0.0 ppm		17.5-18.5: Gray, wet, fine SAND, trace medium to coarse sand, trace shells, semi-cohesive, moderatly stiff, sulfur odor, no visual contamination. (SP)				MODERATE		
			0.0 ppm		18.5-20.0: Dark gray, wet, CLAY, trace to little silt, soft, plastic, cohesive, sulfur odor, no visual contamination. (CH)					-10	
20-25		100	0.0 ppm	20	20.0-25.0: Gray, wet, fine SAND, trace shell fragments, semi-cohesive, moderately stiff, slight sulfur odor, no visual contamination. (SP)						
			0.0 ppm								
			0.0 ppm						FAINT		
			0.0 ppm			23.0-25.0					
			0.0 ppm								
25-30		0			25.0-30.0: No recovery.						
					RPMW-20I WELL CONSTRUCTION: 0.0-1.0: Sand 1.0-16.5: Bentonite chips 16.5-29.8: Sand 0.0-19.8: Riser 19.8-29.8: Screen					-20	
					30.0: End of boring.						

Legend: Physical Observations — None, Sheen, Stain, Heavy

Site Id: RPMW-20S

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.			
Project Number: 982482-9	Project Name: Rockaway Park	Date Started: 12/02/03	Date Completed: 12/02/03
Remarks: No material description due to proximity to RPMW-20I.		Ground Elevation: 8.79'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 12.00'
		Drilling Method: Geoprobe	
		Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology	Vis. Signs of Contamination	Odors	Elevation (ft.)	Well Construction
					NO MATERIAL DESCRIPTION DUE TO PROXIMITY TO RPMW-20I.						
					RPMW-20S WELL CONSTRUCTION: 0.0-1.8: Bentonite Chips 1.8-12.3: Sand 0.0-2.3: Riser 2.3-12.3: Screen				7.0-8.0	0	
				10							

Legend: Physical Observations

None | Sheen | Stain | Heavy

Site Id: RPMW-21I

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.			
Project Number: 982482-9	Project Name: Rockaway Park	Date Started: 12/03/03	Date Completed: 12/03/03
Remarks:		Ground Elevation: 8.96'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 30.00'
		Drilling Method: Geoprobe	
		Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology	Vis. Signs of Contamination	Odors	Elevation (ft)	Well Construction
					0.0-4.0: RPMW-21I cleared by hand for utility concerns.						
					4.0-5.0: Tan, dry, fine SAND, non-cohesive, soft, no odor, no visual contamination. (SP)						
4-5		100									
5-10		84			5.0-10.0: Tan, dry, fine SAND, trace piece of wood, trace shells in bottom 2', becomes wet at 9.0', non-cohesive, slightly stiff, no odor, no visual contamination. (SP)				NONE		
						9.0-10.0				0	
10-15		90		10	10.0-11.8: SAA, wet, trace shells. (SP)						
					11.8-13.6: Tan and gray, wet, fine SAND, trace silt, semi-cohesive, moderately stiff, no odor, no visual contamination. (SP)						
					13.6-17.0: Gray, wet, fine SAND, semi-cohesive, moderately stiff, trace sulfur odor, no visual contamination. (SP)				MODERATE		

Legend: Physical Observations

None | Sheen | Stain | Heavy

Site Id: RPMW-21I

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.	
Project Number: 982482-9	Project Name: Rockaway Park
Remarks:	

Date Started: 12/03/03	Date Completed: 12/03/03
Ground Elevation: 8.96'	Datum: Mean Sea Level
Contractor: ProSonic, Inc.	Total Depth: 30.00'
Drilling Method: Geoprobe	
Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology	Physical Observations	Odors	Elevation (ft)	Well Construction
15-20		80			17.0-17.5: Gray, wet, fine SAND, trace coarse sand, trace fine gravel, semi-cohesive, moderately stiff, sulfur odor, no visual contamination. (SP) 17.5-20.0: Light gray, wet, fine SAND, trace coarse sand, trace shells, semi-cohesive, moderately stiff, sulfur odor, no visual contamination. (SP)					-10	
20-25		100		20	20.0-25.0: Light gray, wet, fine SAND, trace shells, semi-cohesive, moderately stiff, sulfur odor, no visual contamination. (SP)				MODERATE		
25-30		100			25.0-30.0: Gray, wet, fine SAND, little medium sand, trace fine gravel, trace shells, semi-cohesive, moderately stiff, slight sulfur odor, no visual contamination. (SP) RPMW-21I WELL CONSTRUCTION: 0.0-1.0: Sand 1.0-16.0: Bentonite chips 16.0-29.4: Sand 0.0-19.4: Riser 19.4-29.4: Screen 30.0: End of boring.	28.0-29.0			FAINT	-20	

Legend: Physical Observations

None | Sheen | Stain | Heavy

Site Id: RPMW-21S

GEI Consultants, Inc.

Client: Keyspan Energy, Inc.			
Project Number: 982482-9	Project Name: Rockaway Park	Date Started: 12/03/03	Date Completed: 12/03/03
Remarks: No material description due to proximity to RPMW-21I.		Ground Elevation: 9.20'	Datum: Mean Sea Level
		Contractor: ProSonic, Inc.	Total Depth: 12.00'
		Drilling Method: Geoprobe	
		Logged By: Katie Amos	Certified By: Matt O'Neil

Split Spoon Sample Depth (ft.)	Blows Per 6 Inches	Recovery %	PID	Depth (ft.)	Soil Description: color, density, SOIL, admixture, moisture, other notes, ORIGIN.	Analyzed Sample Interval	Lithology Vis. Signs of Contamination	Odors	Elevation (ft)	Well Construction
					NO MATERIAL DESCRIPTION DUE TO PROXIMITY TO RPMW-21I.					
					RPMW-21S WELL CONSTRUCTION: 0.0-1.0: Sand 1.0-1.9: Bentonite Chips 1.9-12.3: Sand 0.0-2.3: Riser 2.3-12.3: Screen					
				10				9.0-10.0	0	

Legend: Physical Observations — None, Stain, Sheen, Heavy

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

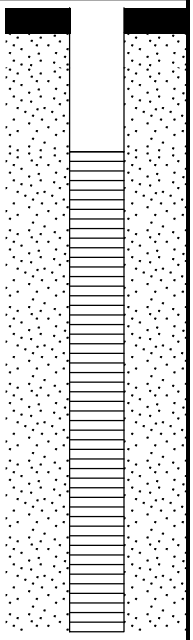
CLIENT: National Grid
PROJECT: Rockaway Park
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-1-1103

BORING LOG
PAGE 1 of 1
RPMW-25S

GROUND SURFACE ELEVATION (FT): 7 **LOCATION:**
NORTHING: 151389.5909 **EASTING:** 1031177.0338 **TOTAL DEPTH (FT):** 16.00
DRILLED BY: Zebra Environmental **DATUM VERT. / HORZ.:** NAVD 88 / NAD83
LOGGED BY: Chris Morris **DATE START / END:** 4/27/2009 - 4/27/2009
DRILLING DETAILS:
WATER LEVEL DEPTHS (FT): ▽ 4.70

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	ODOR	SOIL / BEDROCK DESCRIPTION
0		6.0		0.0			(0'- 0.6') SILTY SAND (SM); brown, HAND CLEARED. (0.6'- 1.5') SILTY SAND (SM); brown, ~20% fill, asphalt, concrete, brick; HAND CLEARED. (1.5'- 2.3') SILT (ML); ~80% fines, ~10% sand, fine; dry, brown, ~10% fill; HAND CLEARED. (2.3'- 5') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; dry, light brown, HAND CLEARED.
▽ 5						SLO	(5'- 6') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; slight sulfur-like odor, wet, light gray, HAND CLEARED.
	S-1	5.0	49	0.4		SLO	(6'- 7.4') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; slight sulfur-like odor, wet, gray.
				0.3			
				0.0			(7.4'- 11') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, light brown.
10				0.0			
	S-2	5.0	39	0.0			(11'- 13') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, light brown.
				0.0			
				0.0			(13'- 14.3') WIDELY GRADED SAND (SW); ~100% sand, fine to coarse; wet, light brown.
				0.0			(14.3'- 14.5') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, light gray.
15				0.0			(14.5'- 15.6') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, dark gray. (15.6'- 16') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, light gray. Bottom of borehole at 16.0 feet.

WELL 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

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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
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

ENVIRONMENTAL BORING LOG 09_GW_INVESTIGATION.GPJ GEI CONSULTANTS.GDT 8/20/09

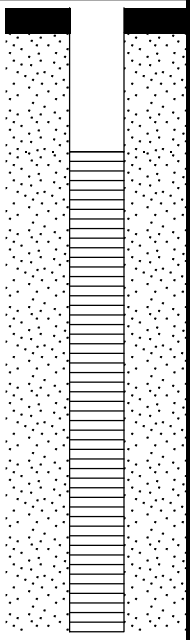
GEI Consultants, Inc.
455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-1-1103

BORING LOG
PAGE 1 of 1
RPMW-26S

GROUND SURFACE ELEVATION (FT): 8.08 **LOCATION:**
NORTHING: 151454.6757 **EASTING:** 1031459.0332 **TOTAL DEPTH (FT):** 16.00
DRILLED BY: Zebra Environmental **DATUM VERT. / HORZ.:** NAVD 88 / NAD83
LOGGED BY: Chris Morris **DATE START / END:** 4/25/2009 - 4/27/2009
DRILLING DETAILS:
WATER LEVEL DEPTHS (FT): ▽ 5.80

DEPTH FT.	SAMPLE INFO TYPE and NO.	PEN FT.	REC FT.	PID (ppm)	STRATA	SOIL / BEDROCK DESCRIPTION	WELL CONSTRUCTION DETAILS
0		6.0		0.0		(0'- 0.3') TOPSOIL; HAND CLEARED.	
				0.0		(0.3'- 1') SILTY SAND (SM); brown, HAND CLEARED.	
				0.0		(1'- 5.5') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; dry, light brown, HAND CLEARED.	
5							
▽				0.0		(5.5'- 6') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; moist, light brown, HAND CLEARED.	
	S-1	5.0	45	0.0		(6'- 11') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, light brown.	
10							
	S-2	4.0	41	0.0		(11'- 16') WIDELY GRADED SAND (SW); ~100% sand, fine to medium; wet, light brown, several small bands of dark brown/black sand.	
15						Bottom of borehole at 16.0 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
MLO = MUSTY LIKE ODOR

ENVIRONMENTAL BORING LOG 09_GW_INVESTIGATION.GPJ GEI CONSULTANTS.GDT 8/20/09

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 2
RW-03

GROUND SURFACE ELEVATION (FT): 6.39 **LOCATION:**
NORTHING (FT): 151838 **EASTING (FT):** 1030727 **TOTAL DEPTH (FT):** 35.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 8/28/2012 - 8/29/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in the 20'-25' interval.

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	5		60/25	PID= 0.0 ppm			OLO	(5'- 10') (FILL); ~10% sand, fine to coarse, ~10% fines; 80% gravel fill, slight organic-like odor, wet, brown.
0								
	10		60/36	PID= 0.0 ppm			NLO	(10'- 12.64') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray.
-5				PID= 0.0 ppm				
				PID= 0.0 ppm				
				PID= 120 ppm			NLO	(12.64'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray and black, free floating product in water; heavily coated with product.
				PID= 48.1 ppm				
	15		60/31	PID= 29.7 ppm			NLO	(15'- 17.1') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, dark gray, lightly coated with product.
-10				PID= 59.4 ppm				
				PID= 89.8 ppm			NLO	(17.1'- 18.23') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, brown and black, lightly to moderately coated with product.
				PID= 35.1 ppm				(18.23'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, dark gray.
				PID= 12.7 ppm			NLO	
	20							

WELL DETAILS

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
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
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CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC_ROCKAWAY PARK.GPJ_NG.GINT DATA TEMPLATE.GDT_11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-03

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/0					(20'- 25') NO RECOVERY.	
-15									
	25		60/49	PID= 0.0 ppm			NLO	(25'- 27.55') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% broken shells, slight naphthalene-like odor, gray.	
-20								(27.55'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
	30		60/34	PID= 0.0 ppm				(30'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
-25									
	35							End of Boring at 35 feet.	

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S_V = TORVANE PEAK

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

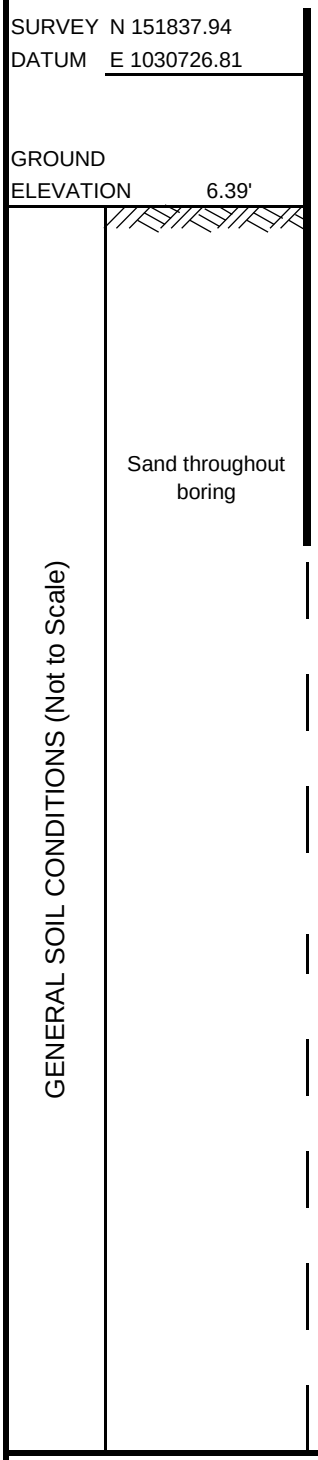
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-03

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-03
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/28/12
Checked by	Chris Morris	Date Completed	8/29/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	2.74'
ELEVATION OF RISER PIPE	8.73'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	3.26'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	9'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	11'
DEPTH TOP OF PERVIOUS SECTION	15'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	25'
DEPTH BOTTOM OF SUMP (FT)	30'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 30 to 13 feet; #00 sand 13 to 11 feet.

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

PAGE 1 of 4

RW-04B

GROUND SURFACE ELEVATION (FT): 5.89 **LOCATION:**
NORTHING (FT): 151845 **EASTING (FT):** 1030759 **TOTAL DEPTH (FT):** 65.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 8/23/2012 - 8/23/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in the 55'-60' interval

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	5		60/23	PID= 0.0 ppm				(5'- 10') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~5% fines; 10% blue stone cobbles, wet, brown.	
0									
	10		60/28	PID= 52.8 ppm PID= 66.6 ppm PID= 177 ppm			NLO	(10'- 12.68') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~5% fines; 10% blue stone cobbles, strong naphthalene-like odor, brown, heavily coated with product.	
-5									
				PID= 233 ppm PID= 411 ppm			NLO	(12.68'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, black, moderately coated with product.	
	15		60/49	PID= 95.8 ppm PID= 244 ppm PID= 182 ppm PID= 373 ppm PID= 297 ppm			NLO	(15'- 17.25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, brown, light to moderately coated with product.	
-10				PID= 305 ppm			NLO	(17.25'- 18.06') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, gray.	
				PID= 233 ppm PID= 282 ppm			NLO	(18.06'- 20') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, brown, light to moderately coated with product.	
	20								

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FT. = FEET

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ALO = ASPHALT LIKE ODOR

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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 2 of 4
RW-04B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-15	20		60/37	PID= 199 ppm PID= 189 ppm PID= 102 ppm			NLO	(20'- 22.03') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, lightly coated with product at bottom of sample.	
				PID= 43.9 ppm			NLO	(22.03'- 22.98') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 111 ppm PID= 414 ppm			NLO	(22.98'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, lightly coated with product at bottom of sample.	
-20	25		60/40	PID= 102 ppm PID= 134 ppm PID= 32.8 ppm PID= 18.9 ppm PID= 6.0 ppm			NLO	(25'- 27.38') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, gray, lightly coated with product.	
							NLO	(27.38'- 27.88') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
				PID= 18.2 ppm			NLO	(27.88'- 28.13') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray, lightly coated with product.	
				PID= 7.2 ppm			NLO	(28.13'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-25	30		60/35	PID= 13.5 ppm PID= 14.1 ppm			NLO	(30'- 31.86') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
				PID= 383 ppm PID= 98.8 ppm			NLO	(31.86'- 34') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, intermittent light coating of product.	
				PID= 223 ppm			NLO	(34'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-30	35		60/27	PID= 163 ppm PID= 249 ppm PID= 381 ppm			NLO	(35'- 37.59') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, free floating product in water.	
				PID= 300 ppm			NLO	(37.59'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown,	

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CITIZENS 2010_ENV/GEO LOG W/SMWC_ROCKAWAY PARK.GPJ_NG GINT DATA TEMPLATE.GDT_11/15/12

GEI Consultants

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CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-04B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
							NLO	heavily coated with product.	
	40		60/14	PID= 382 ppm PID= 299 ppm PID= 307 ppm			NLO	(40'- 45') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, free floating product in water; heavily coated with product.	
-35									
	45		60/44	PID= 279 ppm PID= 202 ppm PID= 220 ppm			NLO	(45'- 46.25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown.	
-40				PID= 196 ppm			NLO	(46.25'- 47.27') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, lightly coated with product.	
				PID= 175 ppm PID= 239 ppm			NLO	(47.27'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown.	
	50		60/22	PID= 132 ppm PID= 148 ppm PID= 159 ppm PID= 67.6 ppm			NLO	(50'- 55') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, lightly coated with product.	
-45									
	55		60/0					NO RECOVERY	
-50									

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

PAGE 4 of 4

RW-04B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	60		60/45	PID= 256 ppm			NLO	(60'- 61.33') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, ~10% fines; strong naphthalene-like odor, gray.	
-55				PID= 248 ppm			NLO	(61.33'- 62') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, ~10% fines; strong naphthalene-like odor, gray, heavily coated with product.	
				PID= 57.1 ppm			NLO	(62'- 63.78') SILTY SAND (SM); ~85% sand, ~15% fines; strong naphthalene-like odor, and slight organic-like odor, gray.	
				PID= 17.8 ppm					
				PID= 11.2 ppm			NLO	(63.78'- 65') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, ~10% fines; strong naphthalene-like odor, gray, moderately coated with product.	
	65			PID= 254 ppm				End of Boring at 65 feet.	

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NLO = NAPHTHALENE LIKE ODOR
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TLO = TAR LIKE ODOR
CLO = CHEMICAL LIKE ODOR
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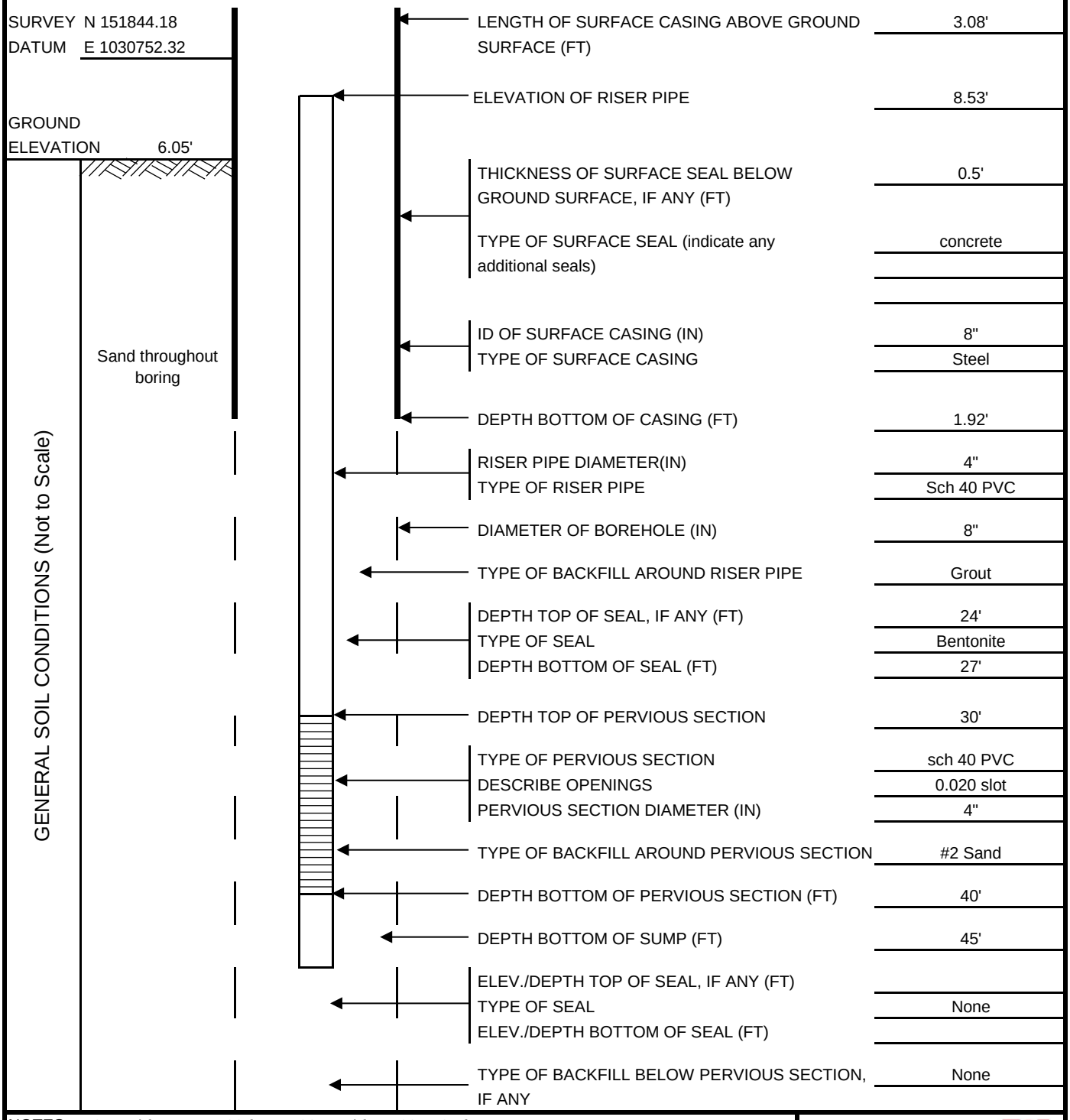
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-04A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG. 1 OF 1	
Client	National Grid	Boring No.	RW-04A
Contractor	Aquifer Drilling & Testing	Driller Joe McGill	Location Onsite
Inspected by	Devin Byrne	Date Started 8/27/12	
Checked by	Chris Morris	Date Completed 8/28/12	Project No. 093150-4-1401



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.08'
ELEVATION OF RISER PIPE	8.53'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.92'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	24'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	27'
DEPTH TOP OF PERVIOUS SECTION	30'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	40'
DEPTH BOTTOM OF SUMP (FT)	45'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand from 45 to 28 feet; # 00 sand from 28 to 27 feet.
The well came up ~.5' when pulling casings.

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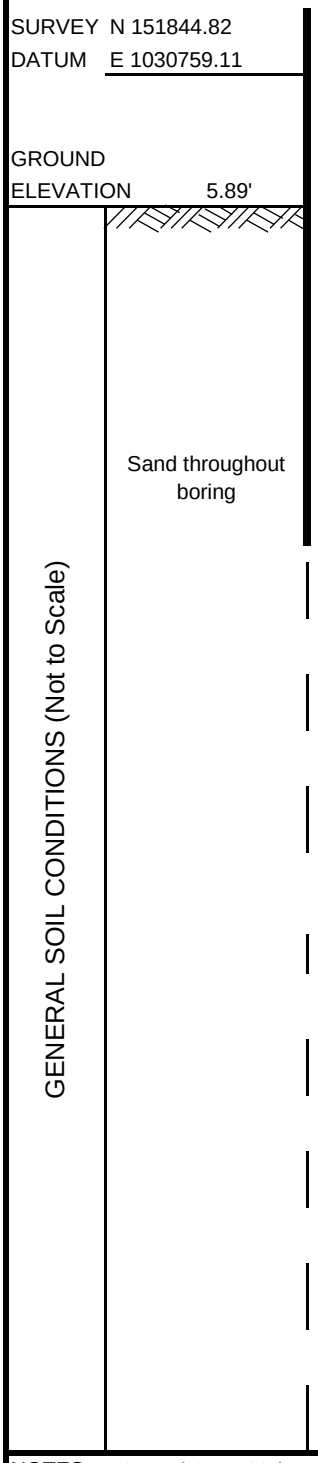
RECOVERY WELL INSTALLATION LOG

RW-04B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-04B
Contractor	Aquifer Drilling & Testing	Driller	Chris Stratton
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/23/12
Checked by	Chris Morris	Date Completed	8/24/2012
Project No.	093150-4-1401		

SURVEY N 151844.82
DATUM E 1030759.11

GROUND ELEVATION 5.89'



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	2.62'
ELEVATION OF RISER PIPE	8.26'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	2.38'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	25'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	29'
DEPTH TOP OF PERVIOUS SECTION	35'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	60'
DEPTH BOTTOM OF SUMP (FT)	65'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 65 to 33 feet; # 00 sand from 33 to 29 feet.

GEI Consultants

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GROUND SURFACE ELEVATION (FT): 5.05 LOCATION:
NORTHING (FT): 151785 EASTING (FT): 1030684 TOTAL DEPTH (FT): 55.0
DRILLED BY: ADT DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Devin Byrne DATE START / END: 8/22/2012 - 8/22/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	5		60/32	PID= 0.7 ppm PID= 0.9 ppm PID= 5.3 ppm PID= 8.1 ppm			NLO	(5'- 7.97') ~10% gravel, fine to coarse, ~5% fines; 85% blue stone fill, slight naphthalene-like odor, brown.	
				PID= 5.2 ppm PID= 9.1 ppm			NLO	(7.97'- 8.59') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, wet, black, odor is slight to moderate; stained sand. (8.59'- 10') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; brown, slight staining.	
-5	10		60/47	PID= 79.7 ppm PID= 153 ppm PID= 172 ppm PID= 112 ppm PID= 124 ppm PID= 89 ppm			NLO	(10'- 13.09') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, black, heavy coating of product; free floating product in water.	
				PID= 139 ppm PID= 184 ppm			NLO	(13.09'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, black, moderate coating of product; free floating product in water.	
-10	15		60/47	PID= 102 ppm PID= 247 ppm PID= 381 ppm PID= 377 ppm			NLO	(15'- 16.81') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, moderately coated with product.	
				PID= 499 ppm PID= 121 ppm PID= 88 ppm			NLO	(16.81'- 18.62') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, intermittent bands of light to moderately coated with product.	
				PID= 244 ppm			NLO	(18.62'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, moderately coated with product.	
	20								

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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BORING LOG

RW-05C

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/41	PID= 88 ppm			NLO	(20'- 20.98') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, moderately coated with product.	
				PID= 122 ppm					
				PID= 107 ppm			NLO	(20.98'- 21.95') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray.	
				PID= 246 ppm					
				PID= 555 ppm			NLO	(21.95'- 22.07') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray, with shells; light to moderately coated with product.	
							NLO	(22.07'- 22.68') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray.	
				PID= 221 ppm			NLO	(22.68'- 23.05') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray, with shells; light to moderately coated with product.	
							NLO	(23.05'- 23.54') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray.	
				PID= 78 ppm			NLO	(23.54'- 24.02') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray, with shells; moderately to heavily coated with product.	
-20	25		60/46	PID= 17.2 ppm				(24.02'- 24.51') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray.	
				PID= 8.4 ppm				(24.51'- 25') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray, with shells; moderately to heavily coated with product.	
				PID= 12.1 ppm			OLO	(25'- 26.09') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; gray.	
				PID= 10.3 ppm				(26.09'- 26.96') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moderate organic-like odor, gray.	
				PID= 18.9 ppm			OLO	(26.96'- 27.17') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moderate organic-like odor, gray, heavily coated with product.	
				PID= 22.0 ppm				(27.17'- 30') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; moderate organic-like odor, gray.	
				PID= 11.1 ppm				(30'- 31.74') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; gray.	
							OLO		
				PID= 14.3 ppm					
-25	30		60/43	PID= 1.7 ppm					
				PID= 3.4 ppm					
				PID= 3.9 ppm					
				PID= 5.1 ppm					
				PID= 122 ppm			NLO	(31.74'- 32.09') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, brown and black, heavily coated with product.	
				PID= 38.7 ppm				(32.09'- 35') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, gray.	
				PID= 44 ppm					
							NLO		
				PID= 24.2 ppm					
-30	35		60/41	PID= 0.7 ppm				(35'- 40') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight organic-like odor, gray.	
				PID= 1.3 ppm					
				PID= 4.6 ppm					
				PID= 5.5 ppm					
							OLO		
				PID= 17.1 ppm					
				PID= 22.2 ppm					

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S_V = TORVANE PEAK

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

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

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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-05C

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 27.1 ppm			OLO		
-35	40		60/50	PID= 56.4 ppm PID= 98 ppm PID= 421 ppm			NLO	(40'- 41.5') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, and gray, lightly coated with product.	
				PID= 322 ppm PID= 61.1 ppm PID= 212 ppm			NLO	(41.5'- 43.1') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, and gray, lightly coated with product.	
				PID= 348 ppm PID= 187 ppm			NLO	(43.1'- 44') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, and gray, lightly coated with product.	
				PID= 142 ppm			NLO	(44'- 45') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, and gray, lightly coated with product.	
-40	45		60/21	PID= 17.2 ppm PID= 28.9 ppm PID= 22.3 ppm PID= 12.0 ppm			NLO	(45'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray, minimal product floating in water.	
-45	50		60/41	PID= 1.1 ppm PID= 0.7 ppm PID= 0.4 ppm PID= 0.4 ppm PID= 3.2 ppm PID= 1.8 ppm				(50'- 55') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
	55			PID= 4.2 ppm				End of Boring at 55 feet.	

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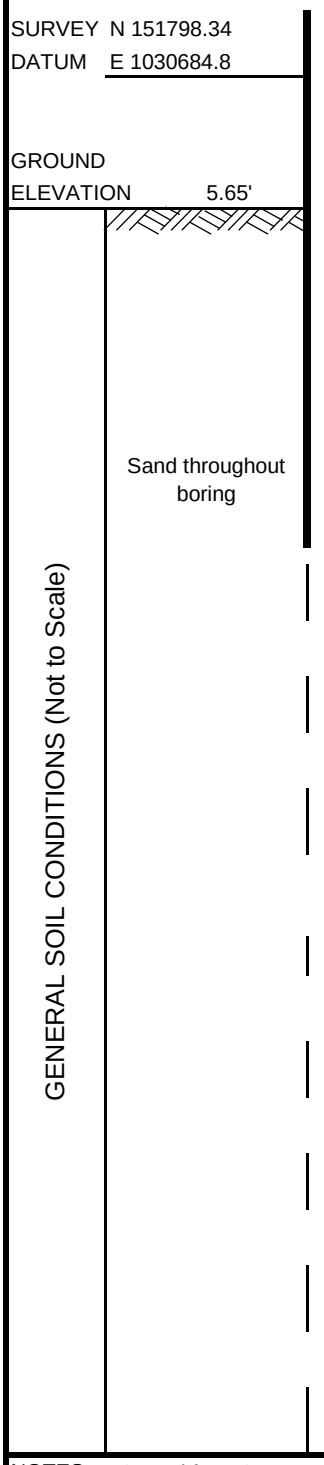
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-05A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-05A
Contractor	Aquifer Drilling & Testing	Driller	Jeremy Meyers
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/9/12
Checked by	Chris Morris	Date Completed	8/10/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.08'
ELEVATION OF RISER PIPE	7.75'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.92'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	3'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	6'
DEPTH TOP OF PERVIOUS SECTION	10.0
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	20'
DEPTH BOTTOM OF SAND COLUMN (FT)	25'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

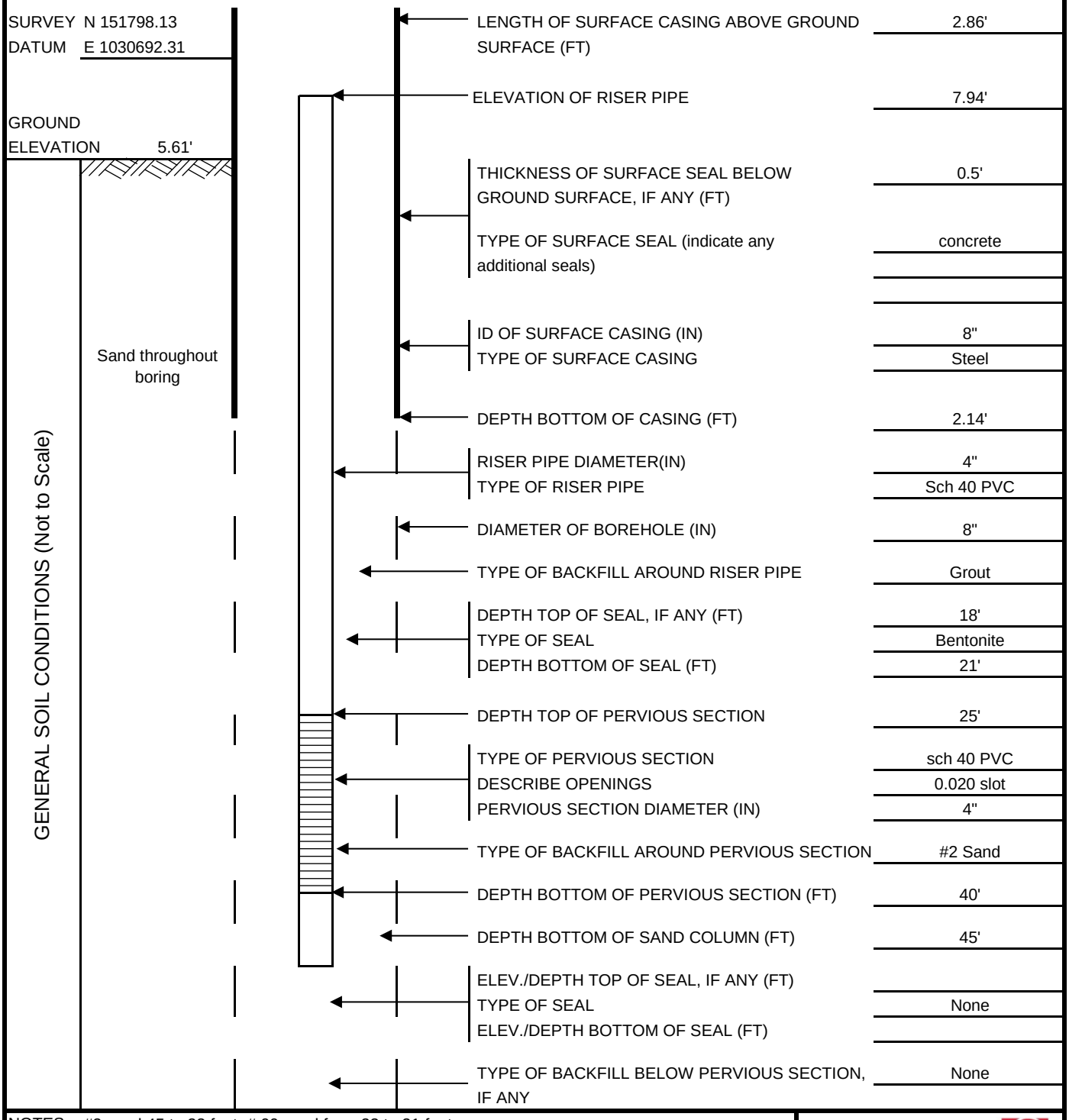
NOTES: #2 sand from 25 to 7.5 feet; # 00 sand from 7.5 to 6 feet.

GEI Consultants

RECOVERY WELL INSTALLATION LOG

RW-05B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-05B
Contractor	Aquifer Drilling & Testing	Driller	Jeremy Meyers
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/14/12
Checked by	Chris Morris	Date Completed	8/15/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	2.86'
ELEVATION OF RISER PIPE	7.94'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	2.14'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	18'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	21'
DEPTH TOP OF PERVIOUS SECTION	25'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	40'
DEPTH BOTTOM OF SAND COLUMN (FT)	45'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

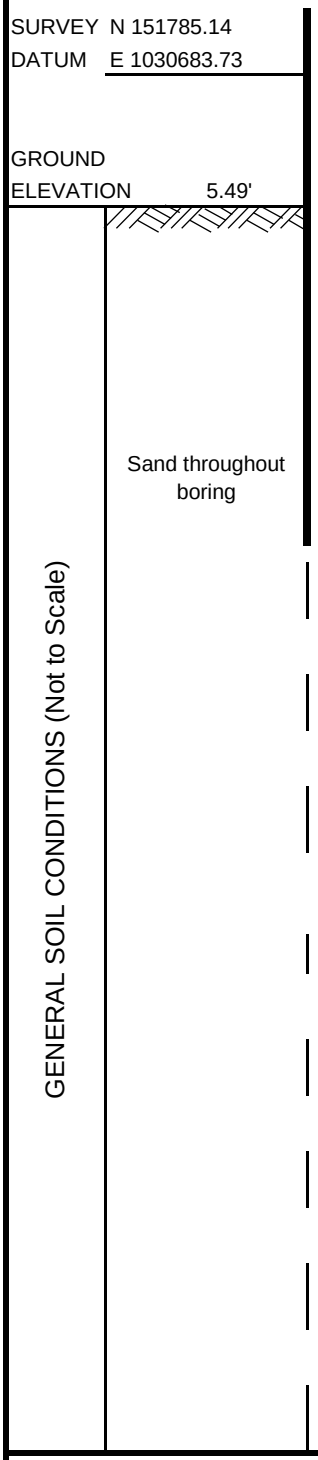
NOTES: #2 sand 45 to 23 feet; # 00 sand from 23 to 21 feet.

GEI Consultants

RECOVERY WELL INSTALLATION LOG

RW-05C

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-05C
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/22/12
Checked by	Chris Morris	Date Completed	8/23/2012
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.04'
ELEVATION OF RISER PIPE	8.24'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.96'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	35'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	37'
DEPTH TOP OF PERVIOUS SECTION	40'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	50'
DEPTH BOTTOM OF SAND COLUMN (FT)	55'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 55 to 38 feet; # 00 sand from 38 to 37 feet.

GEI Consultants

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GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 4
RW-06B

GROUND SURFACE ELEVATION (FT): 5.35 **LOCATION:**
NORTHING (FT): 151804 **EASTING (FT):** 1030730 **TOTAL DEPTH (FT):** 65.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 8/23/2012 - 8/27/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
0	5		60/26	PID= 0.0 ppm				(5'- 8.85') (FILL); 100% gravel fill, slight naphthalene-like odor, wet, Blue stone fill with free floating product in water..	
				PID= 0.0 ppm			NLO		
				PID= 0.3 ppm					
				PID= 1.8 ppm			NLO	(8.85'- 10') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, black.	
-5	10		60/42	PID= 38.0 ppm				(10'- 12.86') (FILL); ~5% fines; 95% rock fragments, moderate naphthalene-like odor, black, Heavily coated blend of broken concete and rock fragments. Free floating product in water..	
				PID= 41.7 ppm					
				PID= 10.0 ppm			NLO		
				PID= 31.0 ppm					
				PID= 105 ppm			NLO	(12.86'- 13.93') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray and black, Moderately coated..	
				PID= 127 ppm			NLO	(13.93'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, Intermittent lightly coated blebs..	
-10	15		60/52	PID= 67.0 ppm				(15'- 16.35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, brown, Lightly coated..	
				PID= 278 ppm					
				PID= 64.0 ppm			NLO		
				PID= 214 ppm			NLO	(16.35'- 17.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, dark gray and brown.	
				PID= 163 ppm			NLO	(17.5'- 17.98') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, dark gray and brown, Lightly coated..	
				PID= 56.7 ppm			NLO	(17.98'- 18.75') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, dark gray and brown.	
				PID= 164 ppm			NLO	(18.75'- 19.42') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like	
	20			PID= 199 ppm			NLO		

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-06B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-15	20		60/46	PID= 260 ppm PID= 296 ppm PID= 346 ppm PID= 155 ppm			NLO	odor, dark gray and brown, Lightly coated.. (19.42'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, dark gray and brown. (20'- 22.39') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, Lightly coated..	
							NLO NLO NLO	(22.39'- 22.61') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 362 ppm PID= 155 ppm PID= 136 ppm			NLO	(22.61'- 22.82') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown. (22.82'- 23.37') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, Moderately coated..	
-20	25		60/43	PID= 170 ppm PID= 11 ppm PID= 186 ppm			NLO NLO	(23.37'- 24.78') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown. (24.78'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 98.8 ppm			NLO	(25'- 26.28') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~5% fines; 5% broken shells, strong naphthalene-like odor, gray.	
				PID= 22.8 ppm PID= 22.9 ppm			NLO	(26.28'- 26.86') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, brown, Lightly coated with product.. (26.86'- 27.44') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, brown and black, Heavily coated with product.. (27.44'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-25	30		60/53	PID= 29 ppm PID= 16.8 ppm PID= 17.1 ppm PID= 21.2 ppm PID= 16.8 ppm PID= 17.5 ppm PID= 33.6 ppm PID= 32.2 ppm			NLO	(30'- 34.06') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
				PID= 62.8 ppm			NLO NLO	(34.06'- 34.25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, brown, Lightly coated with product.. (34.25'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-30	35		60/39	PID= 13.5 ppm PID= 13.6 ppm PID= 46.5 ppm PID= 105 ppm PID= 130 ppm			NLO	(35'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, Intermittent blebs of light to moderately coated material. Some free floating product in water..	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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(860) 368-5300

CLIENT:	National Grid
PROJECT:	Rockaway Park Former MGP
CITY/STATE:	Rockaway Park, New York
GEI PROJECT NUMBER:	093150-4-1401

BORING LOG

PAGE 3 of 4

RW-06B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 132 ppm			NLO		
	40		60/49	PID= 167 ppm PID= 59.4 ppm PID= 135 ppm PID= 137 ppm PID= 240 ppm PID= 234 ppm PID= 50.9 ppm			NLO	(40'- 45') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, Intermittent blebs of light to moderately coated material..	
-35									
	45		60/51	PID= 102 ppm PID= 105 ppm PID= 56.2 ppm PID= 97.9 ppm PID= 50.4 ppm PID= 60.3 ppm PID= 44.2 ppm PID= 288 ppm			NLO	(45'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray and brown, Intermittent blebs of lightly coated material, with some heavy coating and free floating product at the bottom of the sample sleeve..	
-40									
	50		60/40	PID= 319 ppm			NLO	(50'- 51.13') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown.	
-45				PID= 322 ppm			NLO	(51.13'- 51.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown and gray, Moderately coated with product..	
				PID= 413 ppm			NLO	(51.5'- 52.13') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown.	
				PID= 206 ppm			NLO	(52.13'- 52.38') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown and gray, Moderately coated with product..	
							NLO	(52.38'- 52.75') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown.	
				PID= 508 ppm			NLO	(52.75'- 53.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown.	
				PID= 546 ppm PID= 540 ppm			NLO	(53.5'- 55') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, Moderate to heavily coated with product..	
	55		60/48	PID= 335 ppm PID= 418 ppm PID= 454 ppm			NLO		
-50									

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BORING LOG

RW-06B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 328 ppm			NLO	(55'- 57.29') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, Intermittent blebs of light to moderately coated material..	
				PID= 99.7 ppm			NLO		
				PID= 84.4 ppm			NLO	(57.29'- 57.71') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, Moderately coated with product..	
				PID= 122 ppm			NLO	(57.71'- 58.33') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, and moderate organic-like odor, gray.	
				PID= 53.2 ppm				(58.33'- 60') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, and moderate organic-like odor, dark gray.	
	60								
-55			60/32	PID= 22.9 ppm				(60'- 65') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; dark gray.	
				PID= 7.8 ppm					
				PID= 8.2 ppm					
				PID= 1.8 ppm					
				PID= 3.7 ppm					
	65								

End of Boring at 65 feet.

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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

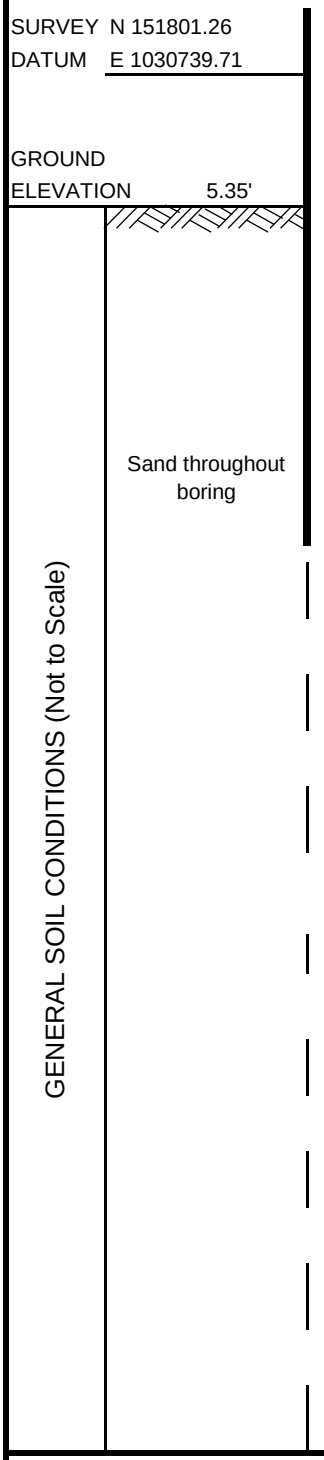
CrLO= CREOSOTE LIKE ODOR
OLO = ORGANIC LIKE ODOR
SLO = SULFUR LIKE ODOR
MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-06A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-06A
Contractor	Aquifer Drilling & Testing	Driller	Jeremy Meyers
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/13/12
Checked by	Chris Morris	Date Completed	8/13/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.29'
ELEVATION OF RISER PIPE	7.95'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.71'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	3'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	6'
DEPTH TOP OF PERVIOUS SECTION	10'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	20'
DEPTH BOTTOM OF SUMP (FT)	25'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

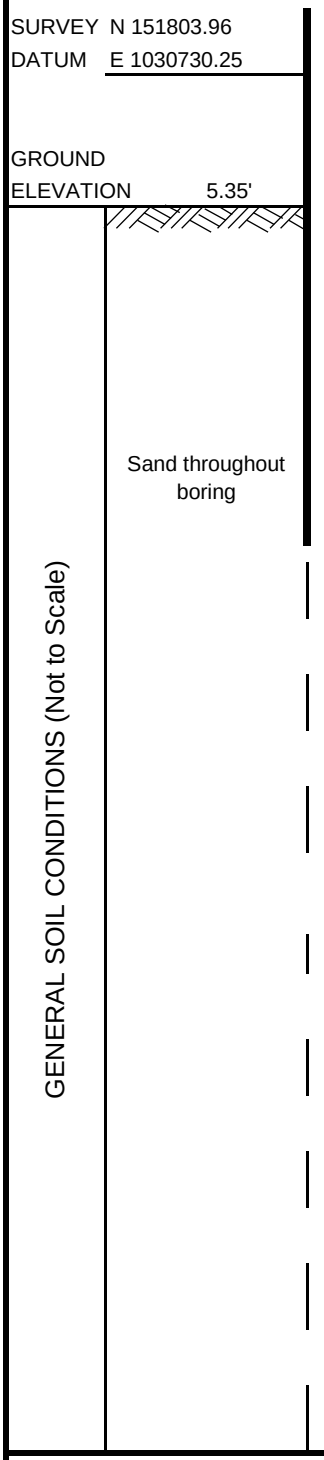
NOTES: #2 sand 25 to 8 feet; # 00 sand 8 to 6 feet.
Well loction moved from planned location due to obstruction in planned location at ~8 ft bgs.

GEI Consultants

RECOVERY WELL INSTALLATION LOG

RW-06B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-06B
Contractor	Aquifer Drilling & Testing	Driller	Jeremy Meyers
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/23/12
Checked by	Chris Morris	Date Completed	8/27/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.38'
ELEVATION OF RISER PIPE	8.34'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.62'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	45'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	47'
DEPTH TOP OF PERVIOUS SECTION	50'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	60'
DEPTH BOTTOM OF SUMP (FT)	65'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 65 to 48.5 feet; # 00 sand from 48.5 to 47 feet.

GEI Consultants

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 4
RW-07B

GROUND SURFACE ELEVATION (FT): 5.55 **LOCATION:**
NORTHING (FT): 151828 **EASTING (FT):** 1030773 **TOTAL DEPTH (FT):** 85.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 8/8/2012 - 8/17/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
0	5		60/26	PID= 0.0 ppm				(5'- 7.69') 100% gravel fill, wet.
								(7.69'- 10') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; gray, sand is tightly compacted.
-5	10		60/33	PID= 103 ppm PID= 70.2 ppm PID= 88.4 ppm PID= 141 ppm			NLO	(10'- 13.18') WIDELY GRADED SAND WITH GRAVEL (SW); ~75% sand, fine to coarse, ~15% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, black, saturated; free floating product in water.
				PID= 177 ppm PID= 49 ppm			NLO	(13.18'- 15') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, black and dark brown, stained; moderate to heavily coated with product.
-10	15		60/44	PID= 274 ppm PID= 293 ppm PID= 288 ppm			NLO	(15'- 16.36') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, black, moderatley coated with product.
				PID= 177 ppm PID= 426 ppm			NLO	(16.36'- 17.27') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, black, light to moderately coated with product.
				PID= 384 ppm			NLO	(17.27'- 17.5') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray, light to moderately coated with product.
				PID= 102 ppm			NLO	(17.5'- 18.07') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, black, light to moderately coated with product.
				PID= 59 ppm			NLO	(18.07'- 18.41') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray, light to moderately coated with product.
-15	20		60/38	PID= 3.4 ppm PID= 3.9 ppm PID= 22.8 ppm PID= 117 ppm PID= 566 ppm			NLO	(18.41'- 19.32') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, black, light to moderately coated with product.
				PID= 422 ppm PID= 193 ppm			NLO	(19.32'- 20') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray, light to moderately coated with product. (20'- 22.24') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray,
	25							

WELL DETAILS

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-07B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-20	25		60/32	PID= 122 ppm PID= 217 ppm PID= 555 ppm PID= 489 ppm PID= 174 ppm PID= 222 ppm			NLO NLO NLO NLO	some slight brown staining toward bottom of sample. (22.24'- 22.76') ORGANIC SOIL WITH SAND (OL/OH); 100% organics, strong naphthalene-like odor, gray. (22.76'- 25') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, and moderate organic-like odor, gray and brown, some coarse sand; light to moderately coated with product. (25'- 28.13') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, ~5% fines; strong naphthalene-like odor, gray, mostly medium to coarse sand; free floating product in water; heavily coated with product. (28.13'- 28.44') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, ~5% fines; strong naphthalene-like odor, gray. (28.44'- 28.75') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, ~5% fines; strong naphthalene-like odor, gray, lightly coated with product. (28.75'- 30') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, ~5% fines; strong naphthalene-like odor, gray. (30'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, free floating product in water; light cloating of product; some brown and black staining.	
-25	30		60/39	PID= 102 ppm PID= 194 ppm PID= 126 ppm PID= 221 ppm PID= 117 ppm PID= 349 ppm PID= 217 ppm			NLO		
-30	35		60/50	PID= 7.9 ppm PID= 13.0 ppm PID= 22.7 ppm PID= 13.4 ppm PID= 31.1 ppm PID= 24.2 ppm PID= 11.0 ppm PID= 9.7 ppm PID= 18.2 ppm			NLO	(35'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-35	40		60/43	PID= 162 ppm PID= 317 ppm PID= 85 ppm PID= 82 ppm PID= 71.6 ppm PID= 52.2 ppm PID= 39.9 ppm			NLO NLO NLO	(40'- 40.7') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray. (40.7'- 41.51') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, lightly coated with product. (41.51'- 45') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray, band of light coated product in middle of sample.	
-40	45		60/39	PID= 71.1 ppm PID= 273 ppm PID= 88 ppm PID= 92 ppm PID= 211 ppm PID= 73 ppm PID= 91 ppm			NLO NLO	(45'- 47.82') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray, band of slight brown staining. (47.82'- 49.49') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark brown, stained and lightly coated with product.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC_ROCKAWAY PARK.GPJ_NG.GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-07B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-45	50		60/42	PID= 291 ppm PID= 139 ppm PID= 88 ppm PID= 44 ppm PID= 24 ppm PID= 19.4 ppm			NLO	(49.49'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray.	
							NLO	(50'- 52.98') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and dark brown, consistent bands of brown staining and lightly coated with product.	
				PID= 11.7 ppm PID= 8.8 ppm			NLO	(52.98'- 55') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
-50	55		60/38	PID= 198 ppm PID= 245 ppm PID= 144 ppm PID= 172 ppm PID= 294 ppm			NLO	(55'- 57.9') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 132 ppm			NLO	(57.9'- 58.95') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, black, light to moderately coated with product.	
				PID= 128 ppm			NLO	(58.95'- 60') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, dark gray, stained; some light coating.	
-55	60		60/50	PID= 15.6 ppm PID= 28.6 ppm PID= 70.5 ppm PID= 202 ppm PID= 18.9 ppm PID= 11.4 ppm PID= 27.2 ppm PID= 36.2 ppm			NLO	(60'- 65') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, dark gray, odor mostly at bottom of sample; some light coating; mostly fine sand.	
-60	65		60/33	PID= 0.0 ppm				(65'- 66.21') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; dark gray.	
							OLO	(66.21'- 66.82') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight organic-like odor, dark black.	
							OLO	(66.82'- 67.73') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight organic-like odor, dark brown.	
								(67.73'- 70') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; light brown.	
-65	70		60/41	PID= 0.0 ppm			OLO	(70'- 75') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight organic-like odor, brown.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid	BORING LOG
	PROJECT: Rockaway Park Former MGP	PAGE 4 of 4
	CITY/STATE: Rockaway Park, New York	RW-07B
	GEI PROJECT NUMBER: 093150-4-1401	

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	75						OLO		
-70			60/38	PID= 0.0 ppm				(75'- 80') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; brown.	
	80		60/33	PID= 0.0 ppm				(80'- 85') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; brown.	
-75									
	85							End of Boring at 85 feet.	

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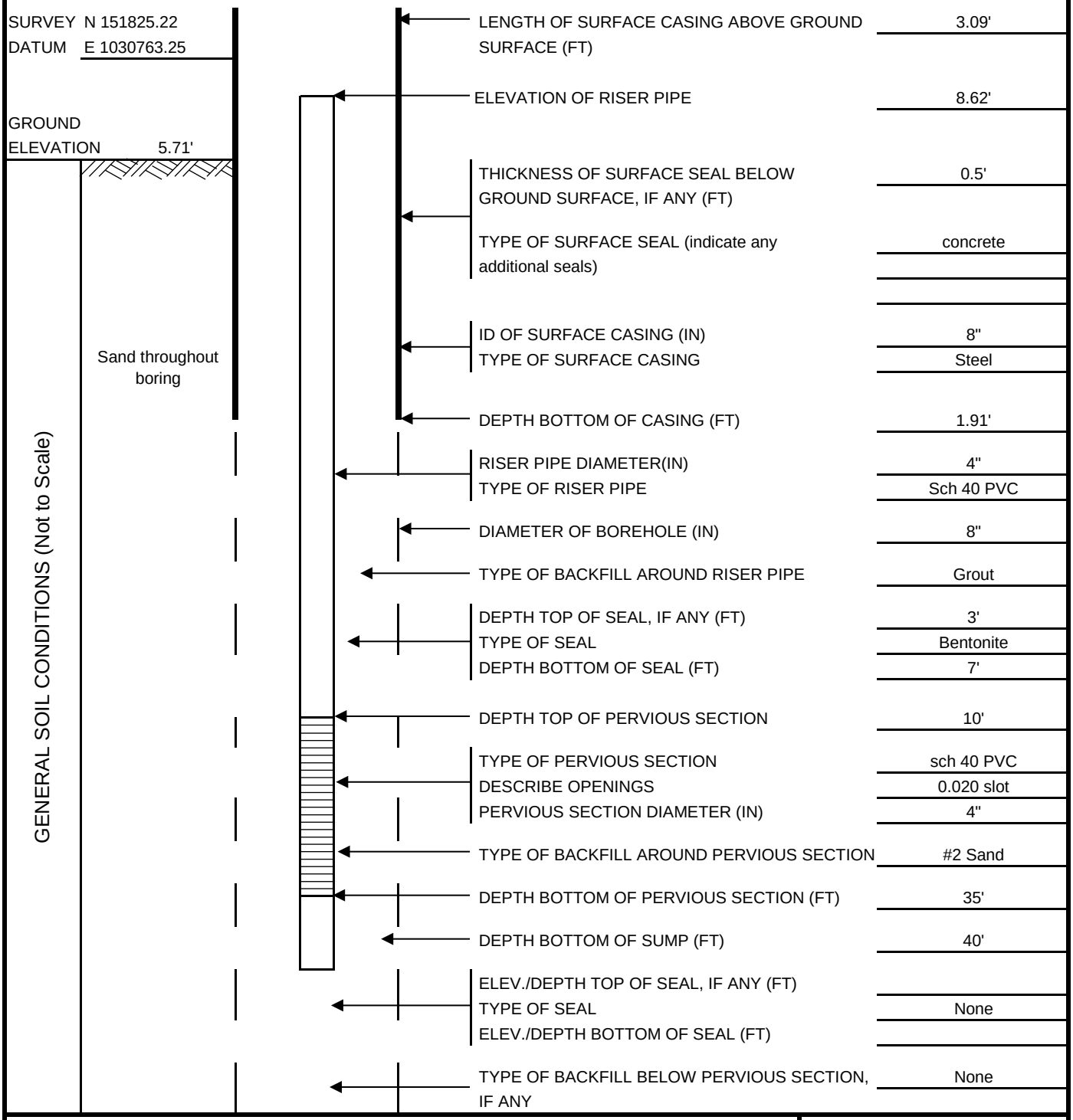
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-07A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-07A
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/21/12
Checked by	Chris Morris	Date Completed	8/22/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.09'
ELEVATION OF RISER PIPE	8.62'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.91'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	3'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	7'
DEPTH TOP OF PERVIOUS SECTION	10'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	35'
DEPTH BOTTOM OF SUMP (FT)	40'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand from 40 to 8 feet; # 00 sand 8 to 7 feet.

GEI Consultants

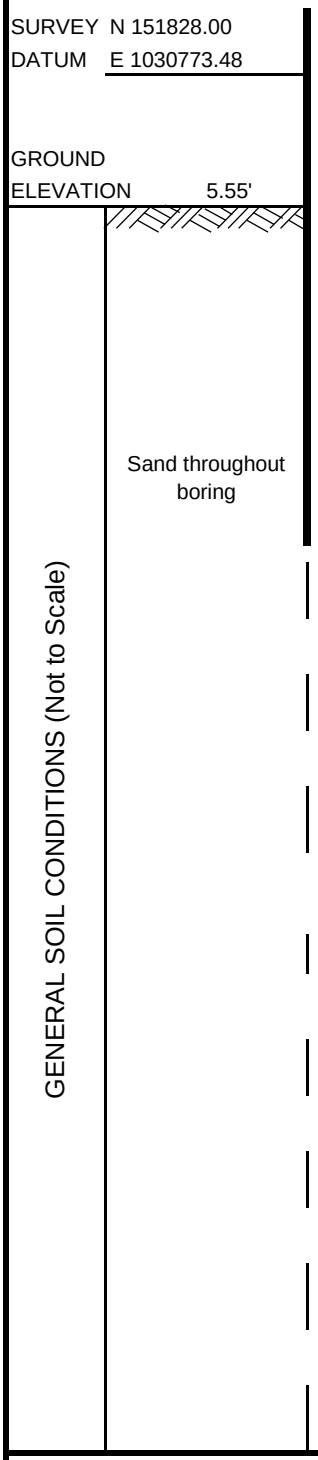
RECOVERY WELL INSTALLATION LOG

RW-07B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-07B
Contractor	Aquifer Drilling & Testing	Driller	Tom Sheerin
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/8/12
Checked by	Chris Morris	Date Completed	8/20/2012
Project No.	093150-4-1401		

SURVEY N 151828.00
DATUM E 1030773.48

GROUND ELEVATION 5.55'



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.15'
ELEVATION OF RISER PIPE	7.64'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.85'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	35'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	37'
DEPTH TOP OF PERVIOUS SECTION	40'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	60'
DEPTH BOTTOM OF SUMP (FT)	65'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	65'
TYPE OF SEAL	Bentonite
ELEV./DEPTH BOTTOM OF SEAL (FT)	85'
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	Bentonite

NOTES: #2 sand 65 to 38 feet; # 00 sand from 38 to 37 feet.
Screened zone amended to 40'-60' based on impacts.

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Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 4
RW-08B

GROUND SURFACE ELEVATION (FT): 5.41 **LOCATION:**
NORTHING (FT): 151786 **EASTING (FT):** 1030781 **TOTAL DEPTH (FT):** 65.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 8/23/2012 - 8/23/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in the 50'-55' interval

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
0	5		60/44	PID= 0.0 ppm				(5'- 8.98') ~10% sand, fine to coarse, ~10% fines; 80% broken gravel and blue stone, black.
							NLO	(8.98'- 10') ~10% sand, fine to coarse, ~10% fines; 80% broken rock, slight naphthalene-like odor, black.
-5	10		60/46	PID= 142 ppm PID= 45.9 ppm PID= 207 ppm PID= 441 ppm			NLO	(10'- 11.85') ~10% sand, fine to coarse, ~10% fines; 80% broken rock, slight naphthalene-like odor, black, some floating product in water.
				PID= 1247 ppm PID= 433 ppm			NLO	(11.85'- 13.37') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, black, heavily coated to saturated with product.
				PID= 281 ppm			NLO	(13.37'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, lightly coated with product.
-10	15		60/45	PID= 453 ppm PID= 474 ppm			NLO	(15'- 16') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.
				PID= 598 ppm			NLO	(16'- 16.11') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, yellow brown, lightly coated with product.
				PID= 48 ppm			NLO	(16.11'- 16.44') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.
				PID= 308 ppm			NLO	(16.44'- 16.56') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, yellow brown, lightly coated with product.
				PID= 88 ppm			NLO	(16.56'- 17.11') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.
				PID= 19.2 ppm			NLO	
	20							

NOTES:

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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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG.GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants, Inc.
455 Winding Brook Road
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CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-08B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-15	20		60/44	PID= 0.0 ppm			NLO	(17.11'- 17.44') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, yellow brown, lightly coated with product. (17.44'- 18') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray. (18'- 18.67') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, light to moderately coated with product. (18.67'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray, odor is slight to moderate. (20'- 23.75') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray. (23.75'- 24.09') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; moderate naphthalene-like odor, brown, lightly coated with product. (24.09'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray. (25'- 26.67') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, brown, light to moderately coated with product. (26.67'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight organic-like odor, and slight naphthalene-like odor, gray.	
				PID= 369 ppm					
				PID= 58.4 ppm					
				PID= 10.9 ppm			NLO		
							NLO		
-20	25		60/36	PID= 607 ppm					
				PID= 370 ppm			NLO		
				PID= 152 ppm					
				PID= 15.6 ppm					
				PID= 0.2 ppm					
				PID= 0.0 ppm			OLO		
-25	30		60/42	PID= 0.0 ppm				(30'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight organic-like odor, and slight naphthalene-like odor, gray.	
							OLO		
-30	35		60/31	PID= 0.0 ppm				(35'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight organic-like odor, gray.	
							OLO		

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-08B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
							OLO		
-35	40		60/38	PID= 0.0 ppm				(40'- 45') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
-40	45		60/18	PID= 0.0 ppm				(45'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray, some light coating of product towards bottom of sample.	
-45	50		60/0					NO RECOVERY	
-50	55		60/35	PID= 0.0 ppm				(55'- 57.14') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; gray.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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PROJECT: Rockaway Park Former MGP
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GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-08B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
								(57.14'- 60') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; dark gray.	
-55	60		60/28	PID= 0.0 ppm			OLO	(60'- 65') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight organic-like odor, dark gray.	
	65							End of Boring at 65 feet.	

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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
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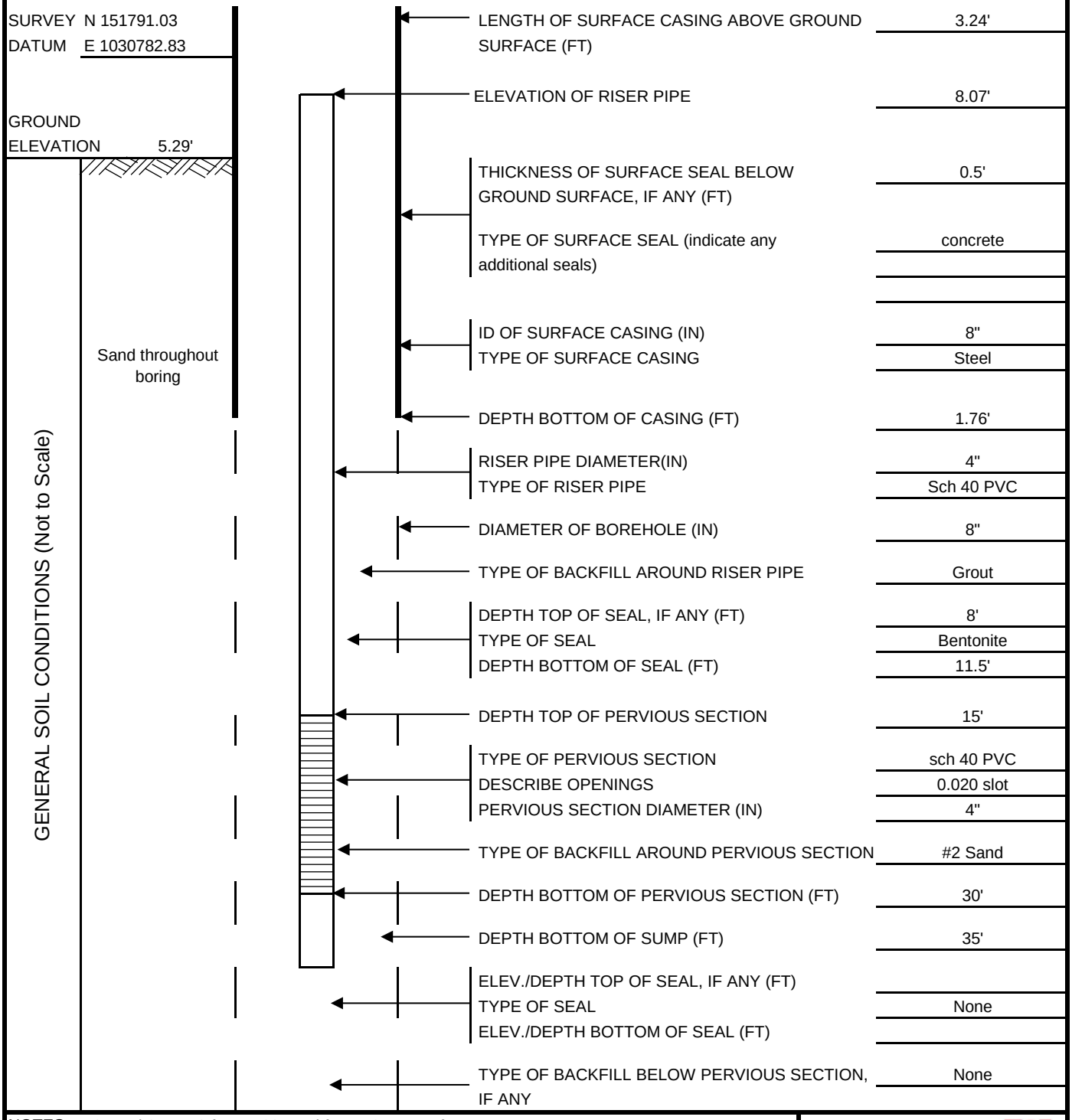
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-08A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-08A
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/31/12
Checked by	Chris Morris	Date Completed	8/31/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.24'
ELEVATION OF RISER PIPE	8.07'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.76'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	8'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	11.5'
DEPTH TOP OF PERVIOUS SECTION	15'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	30'
DEPTH BOTTOM OF SUMP (FT)	35'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 35 to 13 feet; # 00 sand from 13 to 11.5 feet.

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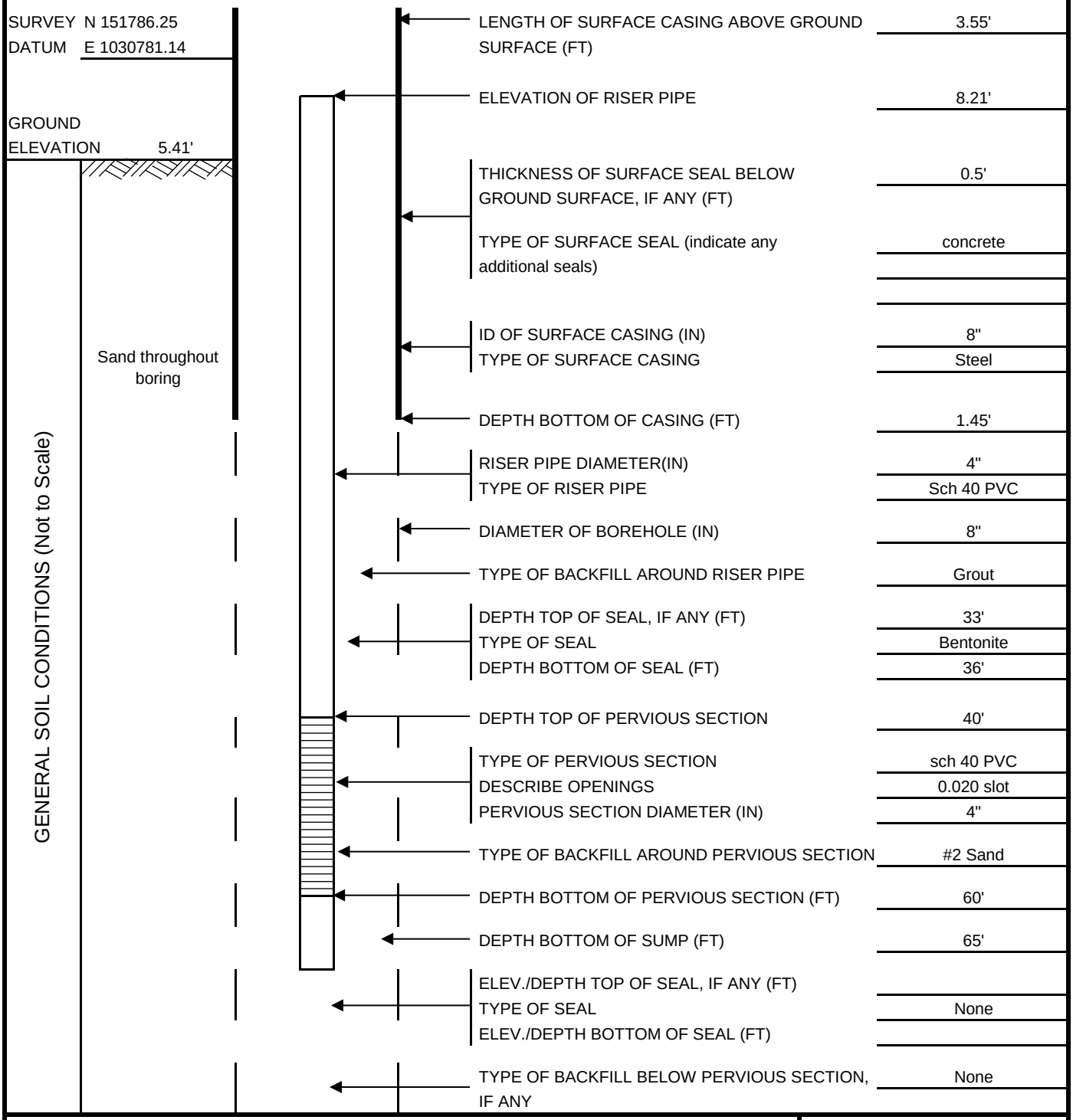
RECOVERY WELL INSTALLATION LOG

RW-08B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-08B
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/28/12
Checked by	Chris Morris	Date Completed	8/28/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.55'
ELEVATION OF RISER PIPE	8.21'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.45'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	33'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	36'
DEPTH TOP OF PERVIOUS SECTION	40'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	60'
DEPTH BOTTOM OF SUMP (FT)	65'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 65 to 37 feet; # 00 sand from 37 to 36 feet.

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CLIENT:	National Grid
PROJECT:	Rockaway Park Former MGP
CITY/STATE:	Rockaway Park, New York
GEI PROJECT NUMBER:	093150-4-1401

BORING LOG

PAGE 1 of 2

RW-09

GROUND SURFACE ELEVATION (FT):	6.09	LOCATION:	
NORTHING (FT):	151851	EASTING (FT): 1030842	TOTAL DEPTH (FT): 35.0
DRILLED BY:	ADT		DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY:	Devin Byrne		DATE START / END: 9/6/2012 - 9/6/2012
DRILLING DETAILS:	Sonic Coring / Compact RotoSonic 17-C		
WATER LEVEL DEPTHS (FT):			
GENERAL NOTE:	Final boring conducted during which the rig lost 1-bolt from the swivle.		

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
0	5		60/33	PID= 0.0 ppm				(5'- 8.03') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel; brown.	
								(8.03'- 10') ~5% gravel, ~5% fines; 90% stone fill.	
-5	10		60/34	PID= 602 ppm PID= 524 ppm PID= 287 ppm PID= 109 ppm PID= 443 ppm PID= 478 ppm			NLO	(10'- 15') ~10% fines; 90% crushed stone, strong naphthalene-like odor, black, saturated with product; free floating product in water.	
-10	15		60/40	PID= 298 ppm PID= 901 ppm PID= 732 ppm PID= 748 ppm			NLO	(15'- 16.75') ~10% fines; 90% crushed stone, strong naphthalene-like odor, black, saturated with product; free floating product in water.	
				PID= 615 ppm PID= 391 ppm PID= 342 ppm			NLO	(16.75'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, light to heavily coated with product (mostly moderately coated).	
-15	20		60/44	PID= 201 ppm PID= 738 ppm			NLO	(20'- 21.14') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 804 ppm PID= 776 ppm PID= 336 ppm PID= 102 ppm PID= 114 ppm			NLO	(21.14'- 23.18') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown, lightly coated with product.	
				PID= 88.0 ppm			NLO	(23.18'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
	25								

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ALO = ASPHALT LIKE ODOR

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-09

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-20	25		60/40	PID= 307 ppm PID= 292 ppm PID= 284 ppm PID= 121 ppm PID= 113 ppm PID= 117 ppm PID= 94.0 ppm			NLO	(25'- 26.63') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, dark brown, moderately coated with product.	
							NLO	(26.63'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-25	30		60/46	PID= 0.0 ppm				(30'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
	35							End of Boring at 35 feet.	

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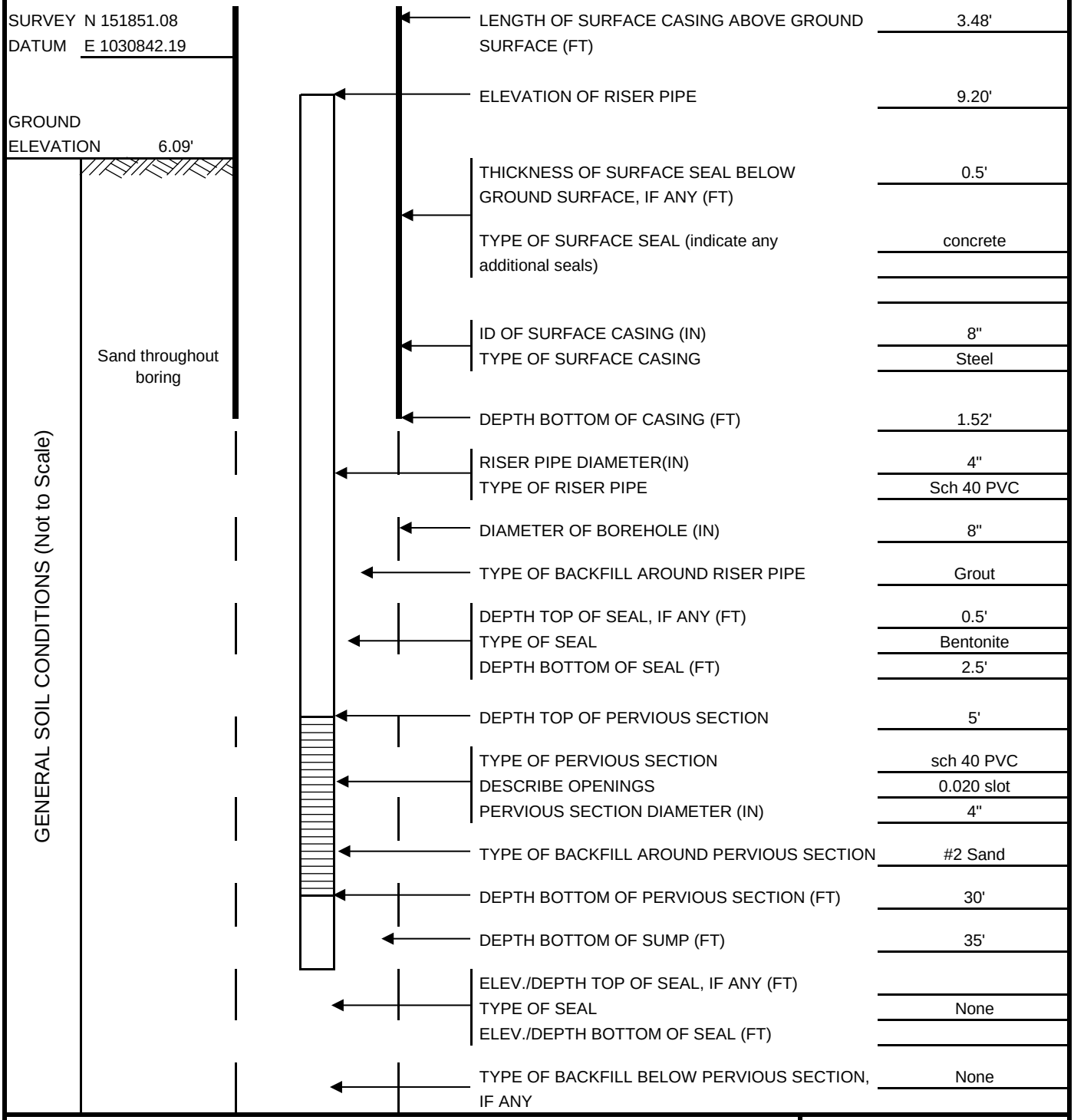
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-09

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-09
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	9/6/12
Checked by	Chris Morris	Date Completed	9/6/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.48'
ELEVATION OF RISER PIPE	9.20'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.52'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	0.5'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	2.5'
DEPTH TOP OF PERVIOUS SECTION	5'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	30'
DEPTH BOTTOM OF SUMP (FT)	35'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 35 to 3 feet; # 00 sand from 3 to 2.5 feet.

GEI Consultants

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GROUND SURFACE ELEVATION (FT): 6.79 LOCATION:
NORTHING (FT): 151871 EASTING (FT): 1030896 TOTAL DEPTH (FT): 35.0
DRILLED BY: ADT DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Devin Byrne DATE START / END: 9/5/2012 - 9/5/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	5		60/43	PID= 0.0 ppm				(5'- 7.79') ~10% gravel, fine to coarse, ~5% sand, fine to coarse, ~5% fines; 80% stone fill.	
0								(7.79'- 9.07') fine to coarse; 100% sand and grout.	
								(9.07'- 10') fine to coarse, ~5% gravel, ~5% fines; 90% stone fill.	
	10		60/31	PID= 10.3 ppm PID= 44.0 ppm PID= 46.0 ppm				(10'- 15') ~5% sand, fine to coarse, ~5% fines; 90% broken stone, strong naphthalene-like odor, and strong creosote-like odor, black, floating product in water; heavily stained.	
-5				PID= 149 ppm			NLO		
				PID= 184 ppm					
				PID= 101 ppm					
	15		60/33	PID= 86.0 ppm			NLO	(15'- 15.61') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 169 ppm PID= 144 ppm				(15.61'- 18.79') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, light brown and black, moderate to heavily coated with product.	
-10				PID= 188 ppm			NLO		
				PID= 189 ppm					
				PID= 194 ppm			NLO	(18.79'- 20') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, black, moderately coated with product.	
	20								

NOTES:

PEN = PENETRATION LENGTH OF SAMPLER OR CORE BARREL
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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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-10

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/36	PID= 0.0 ppm PID= 0.7 ppm PID= 2.1 ppm PID= 2.8 ppm PID= 2.3 ppm				(20'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
-15									
	25		60/40	PID= 308 ppm PID= 294 ppm PID= 86.0 ppm PID= 143 ppm PID= 36.0 ppm PID= 28.0 ppm PID= 22.0 ppm			NLO NLO NLO NLO NLO NLO	(25'- 25.38') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray with dark brown. (25.38'- 26') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray with dark brown, light to moderately coated with product. (26'- 26.75') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray with dark brown. (26.75'- 27.25') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray with dark brown, light to moderately coated with product. (27.25'- 27.5') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray with dark brown.	
-20									
	30		60/39	PID= 2.6 ppm PID= 4.1 ppm PID= 5.7 ppm PID= 8.4 ppm PID= 71.9 ppm				(27.5'- 30') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; slight naphthalene-like odor, gray with dark brown. (30'- 33.46') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; gray.	
-25									
	35			PID= 84.0 ppm PID= 77.0 ppm			NLO	(33.46'- 35') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; moderate naphthalene-like odor, gray and dark brown, light to moderately coated with product. End of Boring at 35 feet.	

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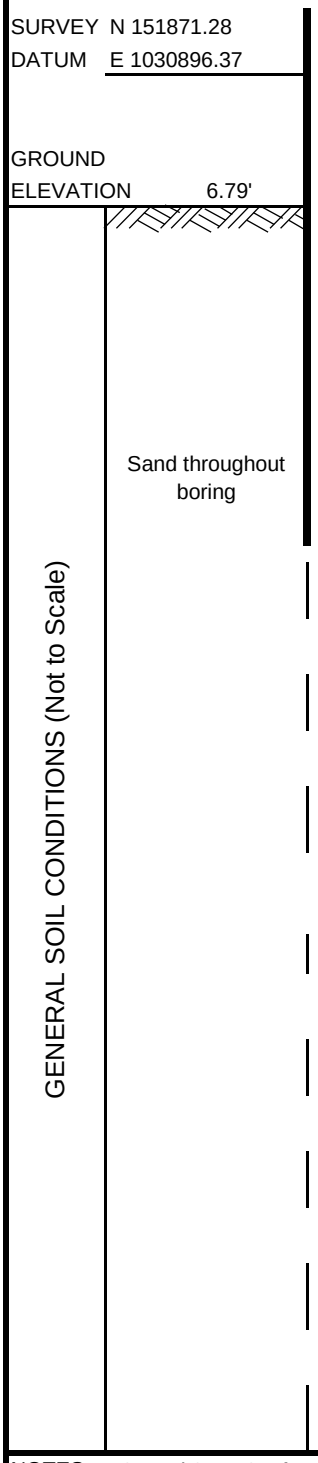
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-10

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG. 1 OF 1	
Client	National Grid	Boring No.	RW-10
Contractor	Aquifer Drilling & Testing	Driller Joe McGill	Location Onsite
Inspected by	Devin Byrne	Date Started 9/4/12	
Checked by	Chris Morris	Date Completed 9/5/12	Project No. 093150-4-1401



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	2.99'
ELEVATION OF RISER PIPE	9.32'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	2.01'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	0.5'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	3'
DEPTH TOP OF PERVIOUS SECTION	5'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	30'
DEPTH BOTTOM OF SUMP (FT)	35'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 35 to 3.5 feet; #00 sand 3.5 to 3 feet

GEI Consultants

GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid	BORING LOG
	PROJECT: Rockaway Park Former MGP	PAGE 1 of 3
	CITY/STATE: Rockaway Park, New York	RW-11
	GEI PROJECT NUMBER: 093150-4-1401	

GROUND SURFACE ELEVATION (FT): 6.65 LOCATION:
NORTHING (FT): 151894 EASTING (FT): 1030948 TOTAL DEPTH (FT): 45.0
DRILLED BY: ADT DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Devin Byrne DATE START / END: 9/4/2012 - 9/4/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	5		60/41	PID= 1.1 ppm PID= 0.9 ppm PID= 2.0 ppm PID= 2.2 ppm				(5'- 6.71') ~10% sand, fine to coarse; 90% stone fill.
0				PID= 1.4 ppm PID= 5.6 ppm				(6.71'- 8.54') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; brown, Micaceous sand.
				PID= 7.2 ppm			NLO	(8.54'- 10') ~10% sand, fine to coarse; 90% stone fill, slight naphthalene-like odor.
	10		60/40	PID= 1.7 ppm PID= 2.2 ppm PID= 2.0 ppm				(10'- 11.25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; brown and black, stained.
-5				PID= 3.7 ppm PID= 22.0 ppm				(11.25'- 13.25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray and brown, stained.
				PID= 29.0 ppm			NLO	(13.25'- 13.38') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, and black, stained.
				PID= 36.0 ppm			NLO	(13.38'- 13.63') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, and black, stained; sticky bleb of tar.
	15		60/30	PID= 18.7 ppm				(13.63'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, and black, stained.
-10				PID= 21.0 ppm PID= 28.0 ppm PID= 162 ppm			NLO	(15'- 18.5') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, wet, dark gray and black, stained; some product free floating in water; lightly coated with product.
				PID= 99 ppm			NLO	(18.5'- 20') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, dark gray with brown, light to moderately coated with product.
	20							

WELL DETAILS

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ALO = ASPHALT LIKE ODOR

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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-11

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/43	PID= 20.7 ppm PID= 22.4 ppm PID= 17.1 ppm PID= 28.1 ppm PID= 44.6 ppm			NLO	(20'- 23.14') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, and gray.	
-15				PID= 55.9 ppm			OLO	(23.14'- 24.07') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate organic-like odor, gray.	
				PID= 67.0 ppm PID= 89.0 ppm			NLO	(24.07'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, and gray.	
	25		60/46	PID= 108 ppm PID= 174 ppm PID= 152 ppm PID= 215 ppm PID= 290 ppm			NLO	(25'- 27.39') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~5% fines; 5% shells, moderate naphthalene-like odor, gray with brown, stained.	
-20				PID= 182 ppm PID= 200 ppm			NLO	(27.39'- 28.7') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, and brown and dark brown, lightly coated with product.	
				PID= 121 ppm			NLO	(28.7'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray.	
	30		60/44	PID= 211 ppm PID= 242 ppm PID= 288 ppm			NLO	(30'- 31.48') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, gray and brown, with shells; lightly coated with product.	
-25				PID= 156 ppm PID= 103 ppm			NLO	(31.48'- 32.27') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark brown, with shells; light to moderately coated with product.	
				PID= 102 ppm			NLO	(32.27'- 32.96') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray with light brown, lightly coated with product.	
				PID= 99.0 ppm PID= 84.0 ppm			NLO	(32.96'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray with light brown.	
	35		60/34	PID= 9.2 ppm PID= 8.4 ppm PID= 11.0 ppm				(35'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
-30				PID= 10.8 ppm PID= 14.7 ppm					

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-11

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 16.1 ppm					
	40		60/27	PID= 84.2 ppm				(40'- 45') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray and brown, light to moderately coated with product; some free floating product in water.	
-35				PID= 192 ppm			NLO		
				PID= 144 ppm					
				PID= 166 ppm					
				PID= 118 ppm					
	45							End of Boring at 45 feet.	

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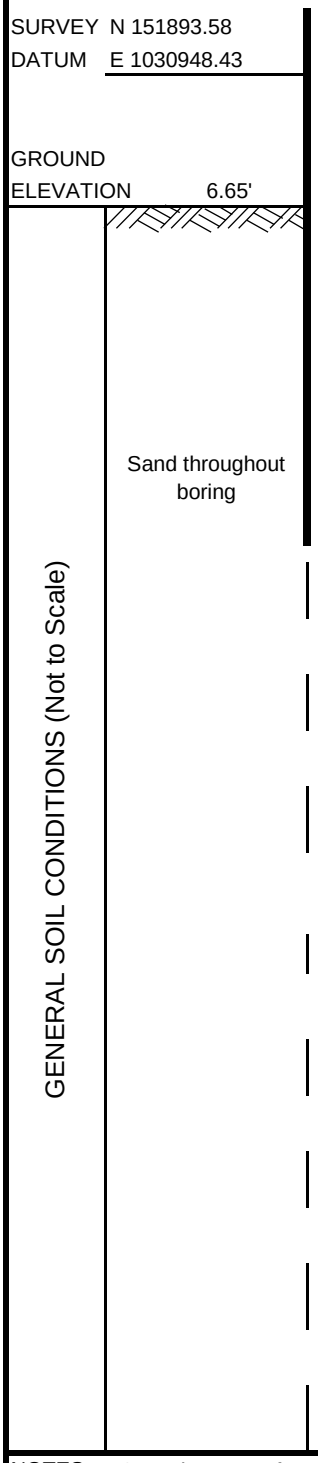
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-11

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG. 1 OF 1	
Client	National Grid	Boring No.	RW-11
Contractor	Aquifer Drilling & Testing	Driller Joe McGill	Location Onsite
Inspected by	Devin Byrne	Date Started 9/4/12	
Checked by	Chris Morris	Date Completed 9/4/12	Project No. 093150-4-1401



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.62'
ELEVATION OF RISER PIPE ABOVE GROUND	9.44
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.38'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	12'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	16'
DEPTH TOP OF PERVIOUS SECTION	20'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	40'
DEPTH BOTTOM OF SUMP (FT)	45'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 45 to 17 feet; # 00 sand from 17 to 16 feet.

GEI Consultants

GEI Consultants, Inc. 455 Winding Brook Road Glastonbury, CT 06033 (860) 368-5300	CLIENT: National Grid PROJECT: Rockaway Park Former MGP CITY/STATE: Rockaway Park, New York GEI PROJECT NUMBER: 093150-4-1401	BORING LOG PAGE 1 of 3 RW-12B

GROUND SURFACE ELEVATION (FT): 6.53 LOCATION:
NORTHING (FT): 151919 EASTING (FT): 1031018 TOTAL DEPTH (FT): 55.0
DRILLED BY: ADT DATUM VERT. / HORZ.: NAVD 88 / NAD 83
LOGGED BY: Devin Byrne DATE START / END: 8/30/2012 - 8/30/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	5		60/35	PID= 12.9 ppm PID= 2.4 ppm PID= 9.2 ppm PID= 10.0 ppm PID= 0.0 ppm				(5'- 10') ~5% sand, fine, ~5% fines; 90% blue stone cobbles.	
0									
	10		60/29	PID= 9.4 ppm PID= 6.2 ppm PID= 11.0 ppm			NLO	(10'- 11.9') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, and strong organic-like odor, wet, dark gray.	
-5				PID= 2.1 ppm PID= 156 ppm PID= 111 ppm			CrLO	(11.9'- 15') 100% wood, strong creosote-like odor, black.	
	15		60/45	PID= 12.0 ppm PID= 148 ppm			NLO	(15'- 16.11') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, and black.	
				PID= 44.0 ppm			NLO	(16.11'- 16.33') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, and black, light to moderately coated with product.	
-10				PID= 279 ppm			NLO	(16.33'- 17') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, and black.	
				PID= 130 ppm PID= 91.0 ppm			NLO	(17'- 17.67') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, and black, moderately coated with product.	
				PID= 23.0 ppm PID= 42.0 ppm			NLO	(17.67'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, dark gray.	
	20								

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-12B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/44	PID= 12.0 ppm PID= 8.0 ppm PID= 5.0 ppm PID= 8.0 ppm PID= 176 ppm PID= 284 ppm				(20'- 22.84') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; dark gray.	
-15				PID= 417 ppm			NLO	(22.84'- 23.41') WIDELY GRADED SAND (SW); ~95% sand, fine to coarse, ~5% fines; moderate naphthalene-like odor, dark brown, lightly coated with product; odor is slight to moderate.	
				PID= 164 ppm			NLO	(23.41'- 24.32') WIDELY GRADED SAND (SW); ~95% sand, fine to coarse, ~5% fines; moderate naphthalene-like odor, dark gray, coated with product at end of sample; odor is slight to moderate.	
	25		60/39	PID= 22.0 ppm PID= 24.0 ppm PID= 21.0 ppm PID= 26.0 ppm PID= 410 ppm				(24.32'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; dark gray. (25'- 27.56') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; dark gray.	
-20							NLO	(27.56'- 27.95') WIDELY GRADED SAND (SW); ~95% sand, fine to coarse, ~5% fines; moderate naphthalene-like odor, brown, lightly coated lens of prodcut.	
				PID= 183 ppm PID= 44.0 ppm			NLO	(27.95'- 30') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, and moderate organic-like odor, dark gray.	
	30		60/29	PID= 5.7 ppm PID= 6.4 ppm PID= 5.9 ppm				(30'- 32.76') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; gray.	
-25				PID= 11.0 ppm				(32.76'- 33.79') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; gray.	
				PID= 48.2 ppm			OLO	(33.79'- 35') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong organic-like odor, gray.	
	35		60/40	PID= 3.8 ppm PID= 8.1 ppm PID= 4.0 ppm PID= 12.0 ppm PID= 11.2 ppm PID= 9.4 ppm PID= 16.1 ppm			OLO	(35'- 40') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight organic-like odor, gray.	
-30									

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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-12B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 35.0 ppm			OLO		
	40		60/38	PID= 0.8 ppm PID= 0.6 ppm PID= 1.7 ppm PID= 4.1 ppm PID= 2.2 ppm PID= 6.4 ppm PID= 12.2 ppm			NLO	(40'- 45') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray.	
-35									
	45		60/29	PID= 110 ppm PID= 123 ppm			NLO	(45'- 47.07') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray, free floating product in water.	
-40				PID= 159 ppm			NLO	(47.07'- 47.59') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray, free floating product in water; heavily coated with product; blebs.	
				PID= 415 ppm			NLO	(47.59'- 48.28') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray, free floating product in water.	
				PID= 236 ppm			NLO	(48.28'- 48.62') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray, free floating product in water; heavily coated with product; blebs.	
	50		60/28	PID= 22.1 ppm				(48.62'- 50') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray, free floating product in water.	
-45				PID= 63.0 ppm PID= 44.0 ppm PID= 78.0 ppm PID= 88.0 ppm			NLO	(50'- 55') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, and gray, minimal floating product in water.	
	55							End of Boring at 55 feet.	

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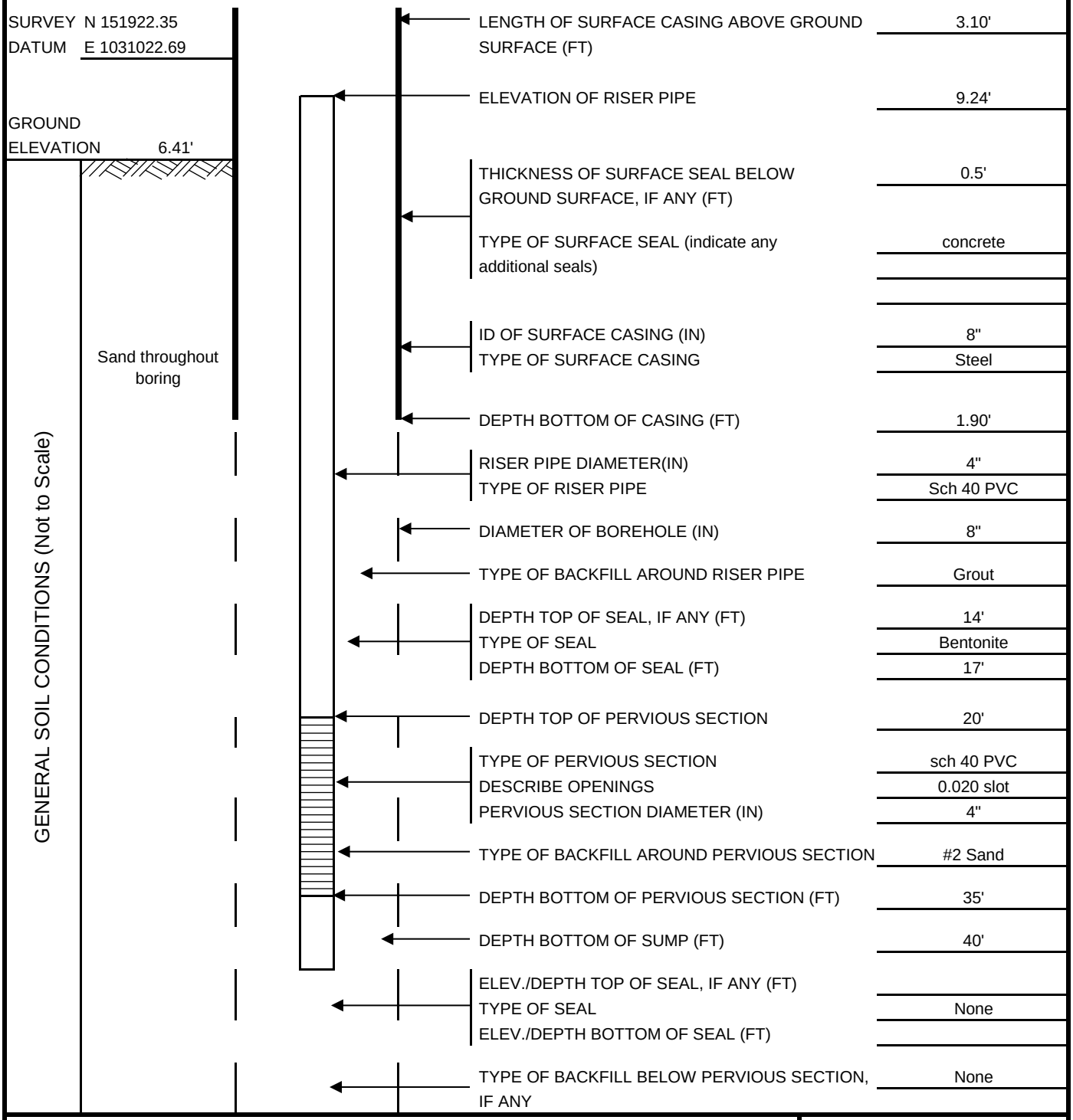
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-12A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-12A
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/30/12
Checked by	Chris Morris	Date Completed	8/31/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.10'
ELEVATION OF RISER PIPE	9.24'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.90'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	14'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	17'
DEPTH TOP OF PERVIOUS SECTION	20'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	35'
DEPTH BOTTOM OF SUMP (FT)	40'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 40 to 18 feet; # 00 sand from 18 to 17 feet.
The well came up ~1.5' when pulling casings, was overdrilled and re-sank, and again bridged and came up ~.5'.

GEI Consultants

RECOVERY WELL INSTALLATION LOG

RW-12B

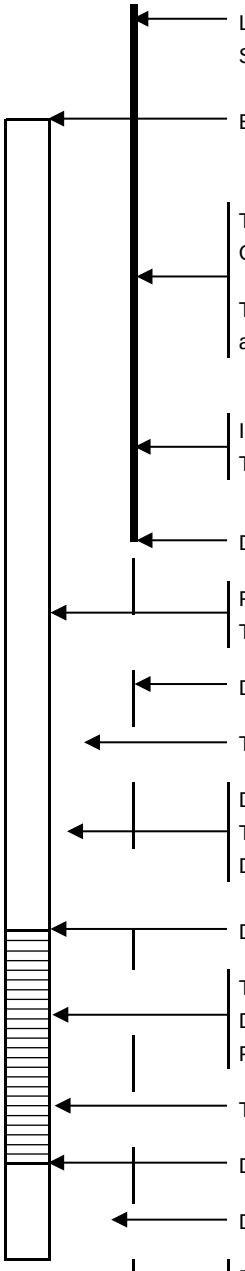
Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-12B
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/30/12
Checked by	Chris Morris	Date Completed	8/30/12
Project No.	093150-4-1401		

SURVEY N 151918.94
DATUM E 1031017.75

GROUND ELEVATION 6.53'

Sand throughout boring

GENERAL SOIL CONDITIONS (Not to Scale)



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.02'
ELEVATION OF RISER PIPE	9.13'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.98'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	30'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	32'
DEPTH TOP OF PERVIOUS SECTION	35'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	50'
DEPTH BOTTOM OF SUMP (FT)	55'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 55 to 33 feet; # 00 sand from 33 to 32 feet.
The well came up ~.5' when pulling casings.

GEI Consultants

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Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 2
RW-13A

GROUND SURFACE ELEVATION (FT): 5.01 **LOCATION:**
NORTHING (FT): 151588 **EASTING (FT):** 1030666 **TOTAL DEPTH (FT):** 45.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 7/24/2012 - 7/24/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Only sampled the three intervals that had no recovery in RW-13B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/42	PID= 1.5 ppm PID= 1.5 ppm PID= 1.5 ppm			(20'- 21.46') WIDELY GRADED SAND (SW-SM); ~90% sand, fine to coarse, ~5% fines; wet, gray.	
				PID= 1.2 ppm PID= 2.6 ppm PID= 2.3 ppm		NLO	(21.46'- 25') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray, lots of shells; odor towards bottom of sample.	
-20	25							
				PID= 0.1 ppm PID= 0.2 ppm PID= 0.4 ppm			(30'- 35') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; gray.	
-25	30							
-30	35							
	40							

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-13A

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	40			PID= 0.0 ppm PID= 0.0 ppm PID= 2.2 ppm PID= 7.4 ppm PID= 1.4 ppm PID= 7.4 ppm		NLO	(40'- 45') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; slight naphthalene-like odor, gray.	
	45						End of Boring at 45 feet.	

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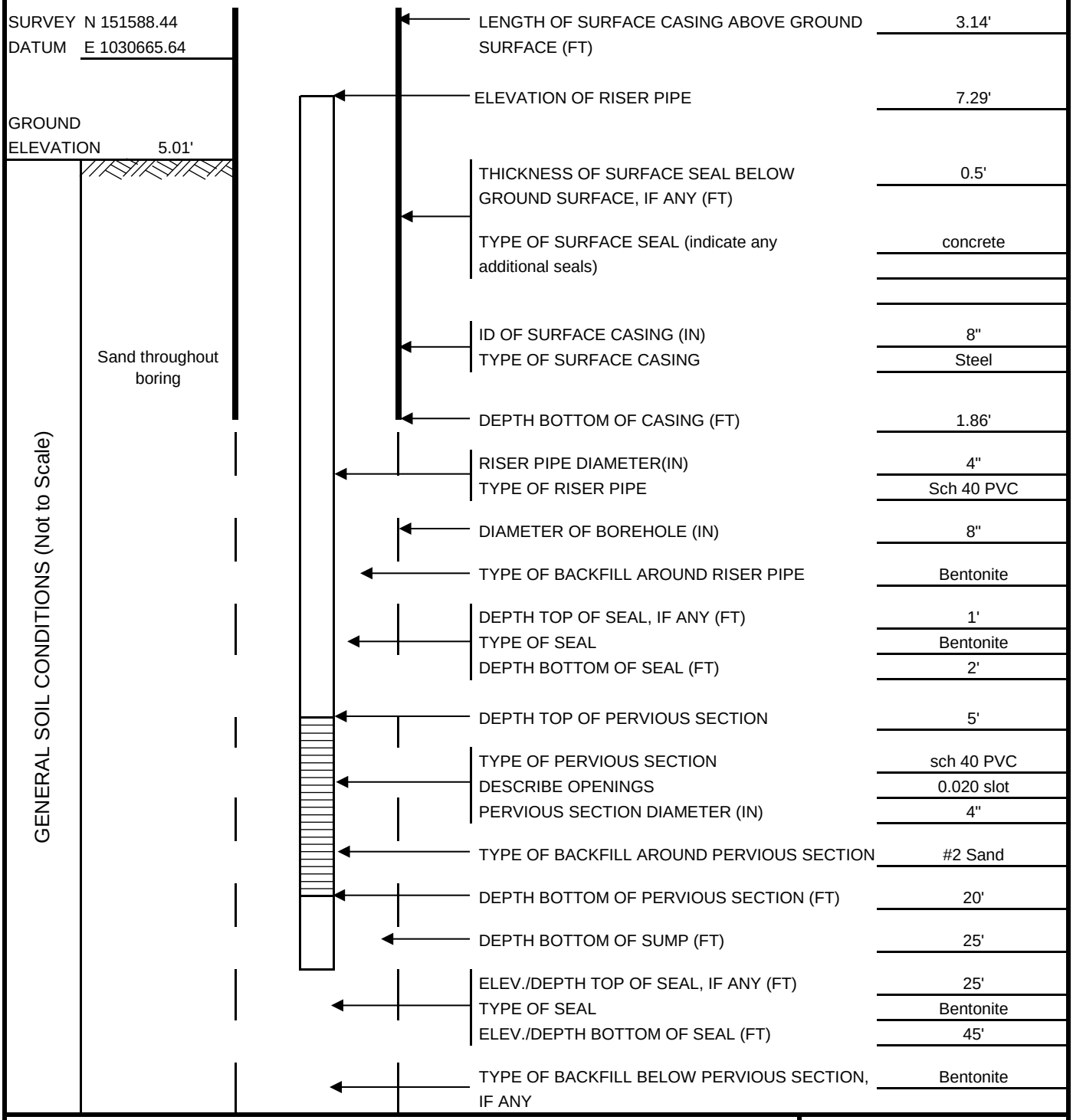
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-13A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-13A
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	7/24/12
Checked by	Chris Morris	Date Completed	7/24/12
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.14'
ELEVATION OF RISER PIPE	7.29'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.86'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Bentonite
DEPTH TOP OF SEAL, IF ANY (FT)	1'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	2'
DEPTH TOP OF PERVIOUS SECTION	5'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	20'
DEPTH BOTTOM OF SUMP (FT)	25'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	25'
TYPE OF SEAL	Bentonite
ELEV./DEPTH BOTTOM OF SEAL (FT)	45'
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	Bentonite

NOTES: Boring advanced to 40-45' to characterize intervals with no recovery from RW-13B.
#2 sand 25 to 3.5 feet; # 00 sand from 3.5 to 2 feet.
The well came up ~6-8" during installation due to swelling of Bentonite backfill.

GEI Consultants

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455 Winding Brook Road
Glastonbury, CT 06033
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CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 4
RW-13B

GROUND SURFACE ELEVATION (FT): 5.05 **LOCATION:**
NORTHING (FT): 151579 **EASTING (FT):** 1030658 **TOTAL DEPTH (FT):** 80.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 7/16/2012 - 7/23/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in intervals 20'-25-; 30'-35'; 40'-45'

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	5		60/37	PID= 12.5 ppm				(5'- 5.54') 100% large stone fill.
				PID= 47.3 ppm			NLO	(5.54'- 7.03') SILTY SAND WITH GRAVEL (SM); ~70% sand, fine to coarse, ~15% gravel, fine to coarse, ~15% fines; strong naphthalene-like odor, wet, gray, with stone fill, blebs of product.
				PID= 23.0 ppm				
				PID= 168 ppm				(7.03'- 8.11') 100% large stone fill, stained.
				PID= 256 ppm			NLO	(8.11'- 10') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray and black, stained; slight to moderate coating.
-5				PID= 161 ppm				
	10		60/49	PID= 97.8 ppm				(10'- 11.43') NARROWLY GRADED SAND (SP); ~95% sand, fine to medium, ~5% fines; strong naphthalene-like odor, gray and black, slight coating.
				PID= 119 ppm			NLO	
				PID= 185 ppm				
				PID= 70.9 ppm				(11.43'- 12.25') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; strong naphthalene-like odor, gray, slight to moderate coating; trace shells.
				PID= 38.1 ppm			NLO	(12.25'- 12.96') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; slight naphthalene-like odor, gray.
				PID= 21.4 ppm			NLO	(12.96'- 13.37') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; slight naphthalene-like odor, dark gray.
				PID= 20.4 ppm			NLO	(13.37'- 15') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; slight naphthalene-like odor, gray.
				PID= 17.3 ppm			NLO	(15'- 17.16') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, gray, with shells.
-10	15		60/58	PID= 1.1 ppm				
				PID= 2.2 ppm				
				PID= 1.7 ppm			NLO	
				PID= 3.4 ppm				
				PID= 26.3 ppm				(17.16'- 18.19') WELL GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, gray, moslty fine to medium sand.
				PID= 37.6 ppm			NLO	(18.19'- 20') WELL GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; slight naphthalene-like odor, gray, moslty fine to medium sand.
				PID= 21.3 ppm				
				PID= 33.3 ppm				
				PID= 11.1 ppm			NLO	
				PID= 14.4 ppm				
-15	20		60/0					(20'- 25') NO RECOVERY.
	25							

WELL DETAILS

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 2 of 4
RW-13B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	25		60/57	PID= 406 ppm PID= 240 ppm PID= 22.3 ppm			NLO	(25'- 26.4') WIDELY GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; strong naphthalene-like odor, gray, with shells; heavily coated.	
				PID= 55.9 ppm PID= 63.1 ppm PID= 31.7 ppm			NLO	(26.4'- 28.16') WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse, ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray.	
				PID= 50.9 ppm PID= 40.3 ppm PID= 57.0 ppm			NLO	(28.16'- 30') WIDELY GRADED SAND WITH SILT (SW-SM); fine to coarse, ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, dark gray, mostly fine to medium sand.	
-25	30		60/0					(30'- 35') NO RECOVERY.	
-30	35		60/30	PID= 0.4 ppm PID= 0.1 ppm PID= 0.5 ppm PID= 2.0 ppm PID= 1.6 ppm			NLO	(35'- 40') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, gray.	
-35	40		60/0					(40'- 45') NO RECOVERY.	
-40	45		60/18	PID= 1.9 ppm PID= 2.2 ppm PID= 1.2 ppm			NLO	(45'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine, ~10% fines; slight naphthalene-like odor, gray.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-13B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-45	50		60/50	PID= 23.2 ppm PID= 12.1 ppm PID= 22.0 ppm PID= 41.8 ppm PID= 44.7 ppm PID= 23.0 ppm PID= 15.7 ppm PID= 26.5 ppm			NLO NLO NLO	(50'- 51.6') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, gray, odor is slight to moderate. (51.6'- 55') WELL GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, gray.	
-50	55		60/26	PID= 5.4 ppm PID= 6.3 ppm PID= 51.1 ppm PID= 598 ppm			NLO NLO	(55'- 58.27') WELL GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, gray. (58.27'- 60') WELL GRADED SAND (SW); ~85% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, gray, w/ shells; tar saturated; seams of moderately coated soil.	
-55	60		60/45	PID= 407 ppm PID= 368 ppm PID= 227 ppm PID= 80.3 ppm PID= 27.4 ppm PID= 20.5 ppm PID= 29.2 ppm			NLO NLO NLO NLO NLO	(60'- 61.78') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, gray, coated with product varying from moderate to heavy; blebs of free product. (61.78'- 62.56') SILTY SAND (SM); ~80% sand, fine, ~20% fines; strong naphthalene-like odor, gray. (62.56'- 63.33') SILTY SAND (SM); ~70% sand, fine, ~30% fines; moderate naphthalene-like odor, gray and light brown. (63.33'- 64.22') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, gray. (64.22'- 65') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, light brown.	
-60	65		60/55	PID= 54.1 ppm PID= 63.1 ppm PID= 13.3 ppm PID= 11.3 ppm PID= 23.9 ppm PID= 83.1 ppm PID= 45.4 ppm PID= 24.2 ppm			NLO NLO NLO NLO	(65'- 66.55') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, gray and dark brown. (66.55'- 68.73') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, light brown. (68.73'- 68.91') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, gray and dark brown.	
-65	70		60/57	PID= 13.5 ppm PID= 6.8 ppm PID= 4.3 ppm PID= 20.5 ppm PID= 24.4 ppm PID= 154 ppm PID= 98.4 ppm PID= 68.6 ppm			NLO NLO	(68.91'- 70') SILTY SAND (SM); ~75% sand, fine, ~25% fines; moderate naphthalene-like odor, gray. (70'- 72.02') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, gray and dark brown. (72.02'- 75') SILTY SAND (SM); ~80% sand, fine, ~20% fines; moderate naphthalene-like odor, light brown and dark brown.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC_ROCKAWAY PARK.GPJ_NG.GINT DATA TEMPLATE.GDT 11/15/12

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CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-13B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-70	75			PID= 25.6 ppm			NLO		
			60/46	PID= 4.1 ppm PID= 32.0 ppm PID= 15.0 ppm PID= 28.2 ppm PID= 30.1 ppm PID= 50.6 ppm PID= 84.4 ppm PID= 66.8 ppm			NLO	(75'- 80') SILTY SAND (SM); ~85% sand, fine, ~15% fines; moderate naphthalene-like odor, brown, odor is slight to moderate.	
	80							End of Boring at 80 feet.	

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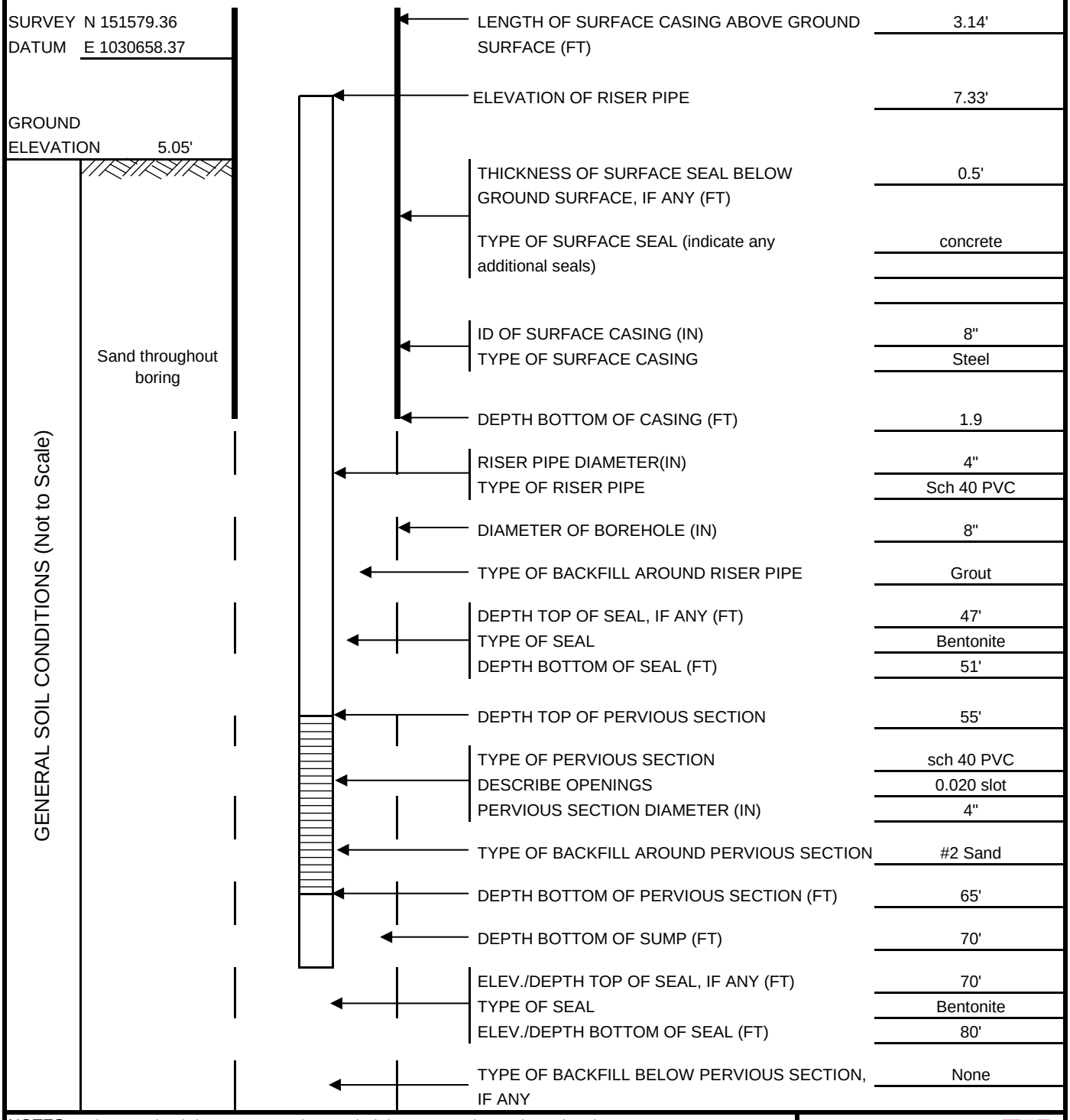
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-13B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-13B
Contractor	Aquifer Drilling & Testing	Driller	Joe McGill
Location	Onsite		
Inspected by	Devin Byrne	Date Started	7/16/12
Checked by	Chris Morris	Date Completed	7/23/12
Project No.	093150-4-1402		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.14'
ELEVATION OF RISER PIPE	7.33'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.9
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	47'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	51'
DEPTH TOP OF PERVIOUS SECTION	55'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	65'
DEPTH BOTTOM OF SUMP (FT)	70'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	70'
TYPE OF SEAL	Bentonite
ELEV./DEPTH BOTTOM OF SEAL (FT)	80'
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: Characterized down to 80' and amended the screened zone based on impacts.
#2 sand 70 to 51 feet; # 00 sand from 53 to 51 feet.

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GEI PROJECT NUMBER:	093150-4-1401

BORING LOG

PAGE 1 of 4

RW-14B

GROUND SURFACE ELEVATION (FT):	4.69	LOCATION:	
NORTHING (FT):	151600	EASTING (FT):	1030692
TOTAL DEPTH (FT):	95.0		
DRILLED BY:	ADT	DATUM VERT. / HORZ.:	NAVD 88 / NAD 83
LOGGED BY:	Devin Byrne	DATE START / END:	7/26/2012 - 7/26/2012
DRILLING DETAILS:	Sonic Coring / Compact RotoSonic 17-C		
WATER LEVEL DEPTHS (FT):			

GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in the 45'-50' interval

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	5		60/43	PID= 0.7 ppm PID= 2.0 ppm PID= 497 ppm PID= 817 ppm			NLO	(5'- 6.74') 100% large stone fill, moderate naphthalene-like odor, wet.
				PID= 728 ppm			NLO	(6.74'- 7.56') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark brown, saturated with product.
				PID= 850 ppm			NLO	(7.56'- 8.26') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, and dark brown, moderately coated with product; moderate to strong odor.
-5				PID= 417 ppm			NLO	(8.26'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, and dark brown, moderate to light coating of product; moderate to strong odor; free product in water.
	10		60/40	PID= 284 ppm PID= 392 ppm PID= 113 ppm PID= 38.6 ppm			NLO	(10'- 11.88') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, and dark brown and gray, alternating bands of tar coated dark brown (75% of core) and gray stained (25%) sands.
				PID= 26.9 ppm			NLO NLO	(11.88'- 12') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, dark gray.
				PID= 41.0 ppm PID= 32.4 ppm			NLO	(12'- 12.25') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, dark gray, lots of shells.
-10								(12.25'- 15') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, dark gray.
	15		60/37	PID= 30.6 ppm PID= 22.4 ppm PID= 152 ppm			NLO	(15'- 17.16') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, dark gray, mostly fine to medium sand.
				PID= 631 ppm			NLO NLO	(17.16'- 17.57') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray, heavily coated with product.
				PID= 74.0 ppm PID= 36.9 ppm			NLO NLO	(17.57'- 17.84') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, dark gray, with sheen.
-15								(17.84'- 18.11') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray, heavily coated with product.
	20		60/41	PID= 18.2 ppm PID= 19.4 ppm PID= 4.1 ppm			NLO	(18.11'- 20') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, dark gray, mostly fine sand.
				PID= 50.4 ppm PID= 76.2 ppm			NLO	(20'- 22.2') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, slight naphthalene-like odor, gray, mostly medium to coarse sand.
				PID= 32.3 ppm				(22.2'- 24.02') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shell fragments, slight naphthalene-like odor,
-20	25							

WELL DETAILS

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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BORING LOG

RW-14B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	25		60/48	PID= 0.2 ppm PID= 0.2 ppm PID= 0.3 ppm PID= 0.2 ppm PID= 0.5 ppm PID= 2.2 ppm PID= 8.9 ppm			NLO	light gray. (24.02'- 25') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shell fragments, light gray, moderately coated with product. (25'- 26.04') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray. (26.04'- 27.08') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray. (27.08'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray.	
-25	30		60/40	PID= 2.5 ppm PID= 2.2 ppm PID= 3.4 ppm PID= 1.8 ppm PID= 12.1 ppm PID= 14.2 ppm			NLO	(30'- 33.57') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray. (33.57'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-30	35		60/43	PID= 1.6 ppm PID= 4.6 ppm PID= 7.8 ppm PID= 23.9 ppm PID= 24.0 ppm PID= 30.9 ppm PID= 44.4 ppm			NLO	(35'- 38.61') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; gray. (38.61'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-35	40		60/41	PID= 1.3 ppm PID= 1.3 ppm PID= 2.5 ppm PID= 5.2 ppm PID= 2.2 ppm PID= 4.7 ppm			NLO	(40'- 45') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-40	45		60/0					No Recovery	

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BORING LOG

RW-14B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-50	50		60/43	PID= 1.0 ppm PID= 0.6 ppm PID= 0.7 ppm PID= 0.6 ppm PID= 1.1 ppm PID= 1.7 ppm PID= 1.2 ppm				(50'- 55') WIDELY GRADED SAND WITH SILT (SW-SM); ~90% sand, fine to coarse, ~10% fines; gray, mostly fine to medium sand.	
	55		60/23	PID= 1.9 ppm PID= 1.9 ppm PID= 2.2 ppm PID= 18.2 ppm				(55'- 59.57') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine; 5% shell fragments, gray and dark gray.	
-55	60		60/45	PID= 86.4 ppm PID= 19.5 ppm PID= 20.4 ppm PID= 30.7 ppm			NLO NLO	(59.57'- 60') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine; 5% shell fragments, slight naphthalene-like odor, gray and dark gray. (60'- 62.56') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine; 5% shell fragments, slight naphthalene-like odor, dark gray.	
-60	65		60/49	PID= 13.0 ppm PID= 7.6 ppm PID= 9.6 ppm PID= 16.6 ppm PID= 12.2 ppm PID= 50.6 ppm PID= 45.2 ppm PID= 59.4 ppm PID= 35.5 ppm PID= 67.7 ppm			NLO NLO NLO NLO	(62.56'- 65') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark gray, Mica in sample. (65'- 67.35') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark gray. (67.35'- 68.88') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark brown.	
-65	70		60/40	PID= 2.9 ppm PID= 2.4 ppm PID= 12.0 ppm PID= 6.4 ppm PID= 11.8 ppm			NLO NLO NLO	(68.88'- 69.29') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark gray. (69.29'- 70') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark brown. (70'- 75') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark brown.	

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BORING LOG

RW-14B

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-70	75			PID= 4.4 ppm			NLO		
			60/34	PID= 11.4 ppm PID= 15.9 ppm PID= 14.2 ppm PID= 8.2 ppm PID= 7.3 ppm			NLO	(75'- 80') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark brown.	
-75	80		60/6	PID= 0.0 ppm				(80'- 85') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; dark brown.	
-80	85		60/31	PID= 2.2 ppm PID= 4.5 ppm PID= 19.8 ppm PID= 9.4 ppm			NLO	(85'- 90') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; slight naphthalene-like odor, dark brown.	
-85	90		60/37	PID= 2.4 ppm PID= 1.8 ppm PID= 2.2 ppm PID= 5.0 ppm PID= 2.2 ppm			NLO	(90'- 95') NARROWLY GRADED SAND (SP); ~95% sand, fine, ~5% fines; slight naphthalene-like odor, dark brown.	
-90	95							End of Boring at 95 feet.	

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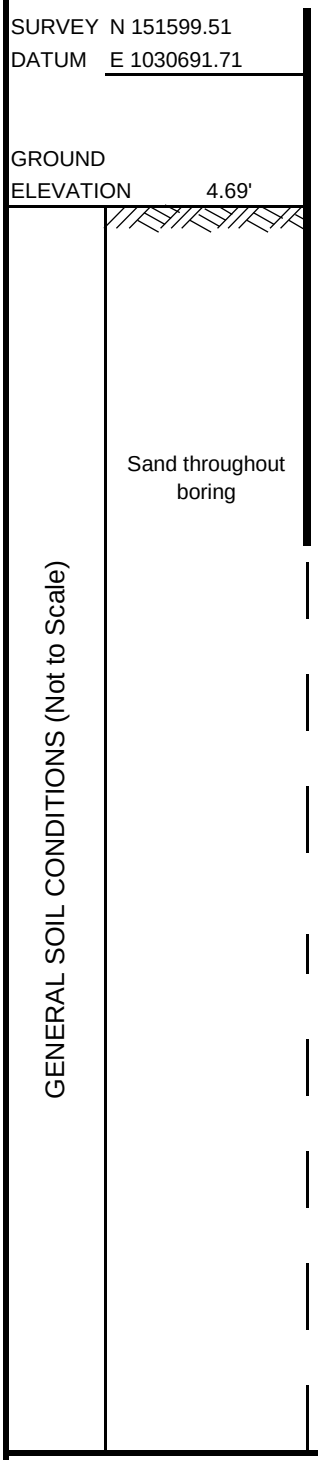
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-14B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-14B
Contractor	Aquifer Drilling & Testing	Location	Onsite
Driller	Joe McGill		
Inspected by	Devin Byrne	Date Started	7/26/12
Checked by	Chris Morris	Date Completed	7/27/12
		Project No.	093150-4-1401



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.19'
ELEVATION OF RISER PIPE	7.14'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.81'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	3'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	5'
DEPTH TOP OF PERVIOUS SECTION	10'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	30'
DEPTH BOTTOM OF SUMP (FT)	35'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	35'
TYPE OF SEAL	Bentonite
ELEV./DEPTH BOTTOM OF SEAL (FT)	95'
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	Bentonite

NOTES: The screened interval was amended to 10-30' based on impacts.
#2 sand 35 to 7 feet; # 00 sand from 7 to 5 feet.
The well came up ~8-10" during installation due to swelling of bentonite backfill.

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 1 of 5
RW-15B

GROUND SURFACE ELEVATION (FT): 4.63 **LOCATION:**
NORTHING (FT): 151615 **EASTING (FT):** 1030728 **TOTAL DEPTH (FT):** 115.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 7/27/2012 - 8/1/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	5		60/36	PID= 9.2 ppm PID= 2.6 ppm PID= 11.2 ppm PID= 37.7 ppm PID= 391 ppm			NLO	(5'- 8.47') 100% blue stone fill, wet, free product in water. (8.47'- 10') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, gray, free product in water; odor is moderate to strong; heavily coated with product.
-5	10		60/53	PID= 30.8 ppm PID= 28.3 ppm PID= 7.4 ppm PID= 118 ppm PID= 39.2 ppm PID= 37.6 ppm PID= 19.3 ppm PID= 17.5 ppm			NLO NLO NLO	(10'- 11.89') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray, heavily coated with product. (11.89'- 12.74') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray, with moderate to heavily coated lenses. (12.74'- 15') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray and black, lightly coated with product.
-10	15		60/49	PID= 133 ppm PID= 526 ppm PID= 66.3 ppm PID= 27.3 ppm PID= 423 ppm PID= 78.8 ppm PID= 25.4 ppm			NLO NLO NLO NLO NLO NLO	(15'- 16.43') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray and black, moderate to heavily coated. (16.43'- 17.35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray, heavily stained. (17.35'- 18.16') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark gray and black, moderate to heavily coated. (18.16'- 19.18') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray, heavily stained.
-15	20		60/39	PID= 10.1 ppm PID= 10.1 ppm PID= 19.8 ppm PID= 10.3 ppm PID= 11.4 ppm PID= 12.7 ppm			NLO	(19.18'- 19.49') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray, heavily stained; with shells and cobbles (~5%). (19.49'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray, heavily stained. (20'- 25') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; strong naphthalene-like odor, dark gray.
-20	25							

WELL DETAILS

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S_V = TORVANE PEAK

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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-15B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	25		60/48	PID= 24.6 ppm PID= 12.1 ppm PID= 11.8 ppm			NLO	(25'- 26.35') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine to coarse, ~5% fines; moderate naphthalene-like odor, gray.	
				PID= 18.4 ppm PID= 22.3 ppm PID= 39.1 ppm PID= 21.3 ppm			NLO	(26.35'- 30') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, gray, odor is slight to moderate; with shells.	
-25	30		60/46	PID= 0.4 ppm PID= 0.0 ppm PID= 0.9 ppm PID= 3.9 ppm PID= 5.8 ppm PID= 2.4 ppm				(30'- 35') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; gray, mostly fine sand.	
-30	35		60/34	PID= 3.5 ppm PID= 2.6 ppm PID= 10.2 ppm PID= 13.1 ppm PID= 60.0 ppm				(35'- 38.24') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; gray, mostly fine sand.	
				PID= 40.2 ppm			NLO	(38.24'- 40') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, gray, mostly fine sand.	
-35	40		60/49	PID= 5.9 ppm PID= 5.1 ppm PID= 25.2 ppm PID= 31.6 ppm PID= 35.2 ppm PID= 52.0 ppm PID= 54.6 ppm			NLO	(40'- 45') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor, gray.	
-40	45		60/39	PID= 0.0 ppm PID= 4.2 ppm PID= 30.0 ppm PID= 22.3 ppm			NLO	(45'- 50') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; slight naphthalene-like odor.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 3 of 5
RW-15B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	50		60/21	PID= 8.5 ppm PID= 6.7 ppm PID= 141 ppm			NLO NLO	(50'- 55') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray, free floating product in water; heavily coated.	
-50	55		60/25	PID= 88.8 ppm PID= 63.3 ppm PID= 85.0 ppm			NLO	(55'- 60') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, free floating product in water; heavily coated; moderate to strong odor.	
-55	60		60/55	PID= 19.3 ppm PID= 58.0 ppm PID= 9.7 ppm PID= 8.3 ppm PID= 0.2 ppm PID= 0.0 ppm PID= 2.6 ppm PID= 0.0 ppm			NLO	(60'- 65') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; slight naphthalene-like odor, gray, with shells and mica.	
-60	65		60/55	PID= 20.2 ppm PID= 5.8 ppm PID= 0.0 ppm PID= 1.4 ppm PID= 3.9 ppm PID= 0.7 ppm PID= 15.2 ppm PID= 17.1 ppm			NLO NLO NLO NLO NLO NLO NLO	(65'- 65.55') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, gray. (65.55'- 66.91') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, dark gray, stained. (66.91'- 67.82') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, gray. (67.82'- 68.18') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, dark gray, stained. (68.18'- 68.46') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, gray. (68.46'- 68.77') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, dark gray, stained. (68.77'- 70') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; slight naphthalene-like odor, gray.	
-65	70		60/50	PID= 0.0 ppm PID= 15.2 ppm PID= 8.2 ppm PID= 30.5 ppm			NLO NLO	(70'- 73.2') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, light brown. (73.2'- 75') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, light brown, with black stained bands of soil.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants, Inc.
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Glastonbury, CT 06033
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CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-15B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
-70	75			PID= 0.0 ppm			NLO	
			60/35	PID= 0.0 ppm PID= 1.1 ppm PID= 0.6 ppm PID= 9.4 ppm				(75'- 77.14') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; brown. (77.14'- 78') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; brown, with black stained bands of soil. (78'- 78.71') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; brown.
-75	80			PID= 28.3 ppm			NLO	(78.71'- 80') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, brown, with black stained bands of soil.
			60/32	PID= 0.0 ppm PID= 9.1 ppm PID= 6.0 ppm PID= 21.7 ppm			NLO	(80'- 83.75') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, black.
-80	85			PID= 120 ppm			NLO	(83.75'- 85') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, black, lightly coated with product; strongest odor at bottom of sample.
			60/36	PID= 13.6 ppm PID= 100 ppm PID= 37.4 ppm			NLO	(85'- 87.22') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, black, light to moderate coating of product.
				PID= 64.2 ppm			NLO	(87.22'- 88.19') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark brown, no coating.
-85	90			PID= 244 ppm			NLO	(88.19'- 90') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, black, heavily coated with product; product free flowing in water.
			60/35	PID= 7.9 ppm PID= 27.9 ppm PID= 20.6 ppm PID= 9.9 ppm PID= 10.0 ppm			NLO	(90'- 95') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, dark brown, oily sheen in water; odor is slight to moderate.
-90	95			PID= 0.3 ppm			NLO	(95'- 100') SILTY SAND (SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, brown, odor is slight to moderate.

WELL DETAILS

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CITIZENS 2010_ENV/GEO LOG W/SMWC_ROCKAWAY PARK.GPJ_NG.GINT DATA TEMPLATE.GDT_11/15/12

GEI Consultants

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PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-15B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-95	100			PID= 0.0 ppm			NLO		
			60/48	PID= 0.0 ppm				(100'- 103.75') SILTY SAND (SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, brown.	
				PID= 1.5 ppm			NLO		
				PID= 0.0 ppm					
-100							NLO	(103.75'- 105') SILTY SAND (SM); ~85% sand, fine to medium, ~10% fines; slight naphthalene-like odor, brown and light gray.	
	105		60/6	PID= 0.0 ppm				(105'- 110') SILTY SAND (SM); ~85% sand, fine to medium, ~10% fines; brown and light gray.	
-105									
	110		60/46	PID= 0.0 ppm				(110'- 115') SILTY SAND (SM); ~90% sand, fine to medium, ~10% fines; brown.	
-110	115							End of Boring at 115 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
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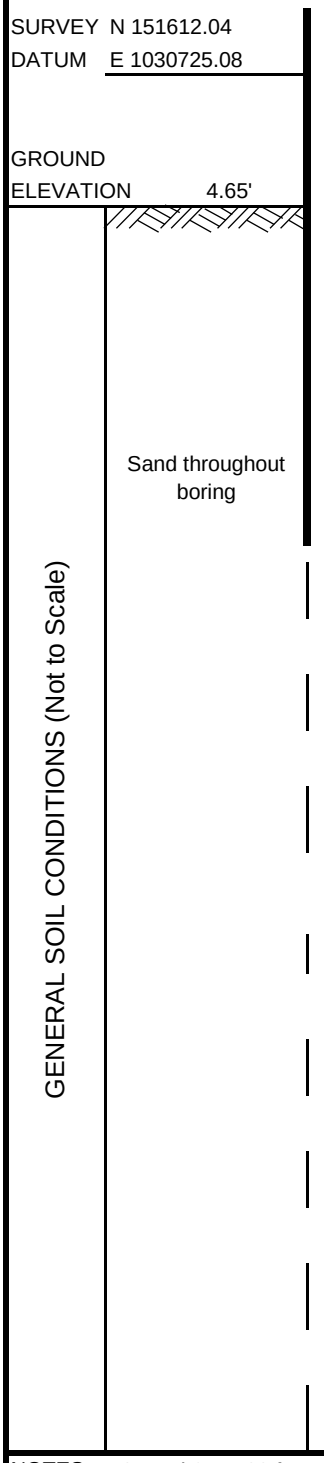
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-15A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-15A
Contractor	Aquifer Drilling & Testing	Driller	Jeremy Meyers
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/3/12
Checked by	Chris Morris	Date Completed	8/6/2012
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.13'
ELEVATION OF RISER PIPE	7.42'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.87'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	32'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	36'
DEPTH TOP OF PERVIOUS SECTION	40'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	60'
DEPTH BOTTOM OF SUMP (FT)	65'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 65 to 38 feet; # 00 sand from 38 to 36 feet.

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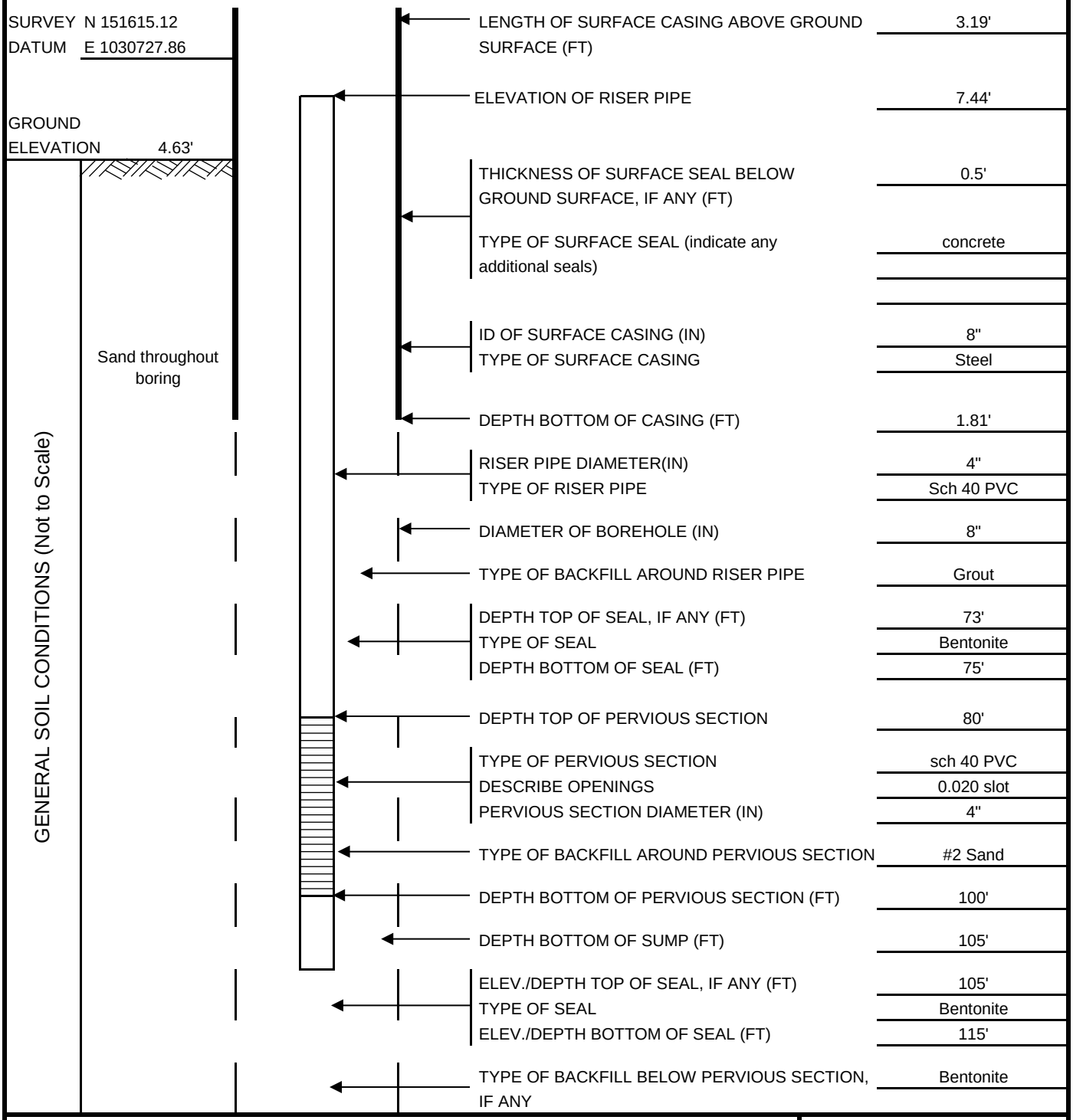
RECOVERY WELL INSTALLATION LOG

RW-15B

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG. 1 OF 1	
Client	National Grid	Boring No.	RW-15B
Contractor	Aquifer Drilling & Testing	Driller Joe McGill	Location Onsite
Inspected by	Devin Byrne	Date Started 7/27/12	
Checked by	Chris Morris	Date Completed 8/2/2012	Project No. 093150-4-1401



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.19'
ELEVATION OF RISER PIPE	7.44'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.81'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	73'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	75'
DEPTH TOP OF PERVIOUS SECTION	80'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	100'
DEPTH BOTTOM OF SUMP (FT)	105'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	105'
TYPE OF SEAL	Bentonite
ELEV./DEPTH BOTTOM OF SEAL (FT)	115'
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	Bentonite

NOTES: The screened interval was amended to 80-100' based on impacts.
#2 sand 105 to 77 feet; # 00 sand from 77 to 75 feet.

GEI Consultants

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CLIENT: National Grid
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BORING LOG
PAGE 1 of 3
RW-16A

GROUND SURFACE ELEVATION (FT): 4.55 **LOCATION:**
NORTHING (FT): 151573 **EASTING (FT):** 1030716 **TOTAL DEPTH (FT):** 50.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 8/7/2012 - 8/7/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in the 40'-45' interval

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	PEN/REC IN./IN.	FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION
	5		60/23	PID= 97.7 ppm PID= 149 ppm PID= 281 ppm PID= 449 ppm			NLO	(5'- 8.48') 100% gravel fill & blue stone, strong naphthalene-like odor, wet, stained; moderate to strong odor.
-5	10		60/39	PID= 135 ppm PID= 160 ppm PID= 321 ppm PID= 543 ppm PID= 148 ppm PID= 141 ppm PID= 97 ppm			NLO	(8.48'- 10') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, black, moderate to heavily coated. (10'- 11.28') 100% gravel fill, strong naphthalene-like odor, stained; free floating product in water. (11.28'- 12.69') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, brown and gray, lightly coated with product. (12.69'- 13.85') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, black, light to moderate coated; moderate to strong odor. (13.85'- 15') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, brown and gray, lighlt coated with product.
-10	15		60/38	PID= 4.9 ppm PID= 6.1 ppm PID= 14.2 ppm PID= 68.1 ppm PID= 481 ppm PID= 46.5 ppm PID= 120 ppm			NLO	(15'- 18.03') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, slight naphthalene-like odor, gray. (18.03'- 18.95') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, strong naphthalene-like odor, black, moderate to heavily coated with product. (18.95'- 20') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, strong naphthalene-like odor, gray and black, lightly coated with product; moderate to strong odor.
-15	20						NLO	

WELL DETAILS

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FT. = FEET

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CrLO= CREOSOTE LIKE ODOR
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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG
PAGE 2 of 3
RW-16A

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	20		60/41	PID= 13.9 ppm PID= 83.4 ppm PID= 178 ppm			NLO	(20'- 21.34') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shell fragments, moderate naphthalene-like odor, gray, some staining.	
				PID= 394 ppm PID= 491 ppm PID= 329 ppm			NLO	(21.34'- 23.17') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, moderate naphthalene-like odor, black and dark brown, moderately coated with product; mostly medium to coarse sand.	
				PID= 71 ppm			NLO	(23.17'- 23.9') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shell fragments, moderate naphthalene-like odor, gray, some staining.	
-20				PID= 192 ppm			NLO NLO NLO	(23.9'- 24.15') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, moderate naphthalene-like odor, black and dark brown, moderately coated with product; mostly medium to coarse sand. (24.15'- 24.63') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shell fragments, moderate naphthalene-like odor, gray, some staining.	
	25		60/29	PID= 82.5 ppm PID= 92.1 ppm PID= 294 ppm			NLO	(24.63'- 25') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% fines; 5% shell fragments, moderate naphthalene-like odor, black and dark brown, moderately coated with product; mostly medium to coarse sand. (25'- 28.1') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, gray and brown, light to moderate coating of product; free floating product in water.	
-25				PID= 192 ppm PID= 108 ppm			NLO	(28.1'- 30') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; strong naphthalene-like odor, dark brown, heavily coated.	
	30		60/49	PID= 3.7 ppm PID= 9.7 ppm			NLO	(30'- 31.12') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
				PID= 21.7 ppm PID= 129 ppm			NLO	(31.12'- 32.04') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, brown and dark brown, blebs and lightly coated with product.	
-30				PID= 101 ppm PID= 96 ppm PID= 24 ppm PID= 11.3 ppm			NLO	(32.04'- 35') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
	35		60/39	PID= 57.9 ppm PID= 27.3 ppm PID= 84.7 ppm			NLO	(35'- 37.05') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray.	
				PID= 399 ppm			NLO	(37.05'- 37.31') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark brown, lightly coated with product.	
				PID= 29.2 ppm			NLO	(37.31'- 40') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90%	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-16A

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-35	40			PID= 24.7 ppm PID= 26.2 ppm			NLO	sand, fine to medium, ~10% fines; moderate naphthalene-like odor, gray.	
			60/0					NO RECOVERY	
-40	45			PID= 0.0 ppm PID= 4.6 ppm PID= 7.2 ppm PID= 32.4 ppm PID= 41.0 ppm			NLO	(45'- 50') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; slight naphthalene-like odor, gray.	
-45	50			PID= 22.1 ppm				End of Boring at 50 feet.	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-16A

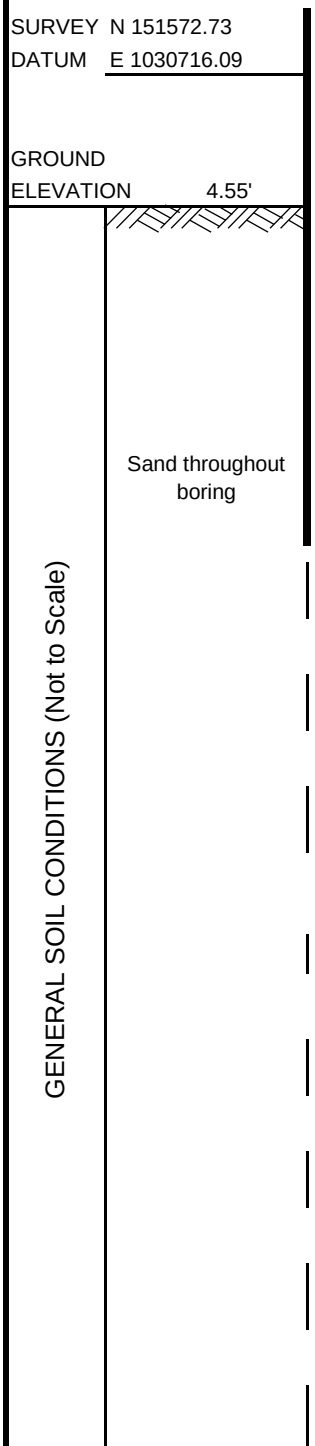
Project	Rockaway Park Former MGP
Location	Rockaway Park, NY
Client	National Grid
Contractor	Aquifer Drilling & Testing
Driller	Jeremy Meyers
Inspected by	Devin Byrne
Date Started	8/7/12
Checked by	Chris Morris
Date Completed	8/7/2012

PG. 1 OF 1

Boring No.	RW-16A
Location	Onsite
Project No.	093150-4-1401

SURVEY N 151572.73
DATUM E 1030716.09

GROUND ELEVATION 4.55'



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.22'
ELEVATION OF RISER PIPE	6.88'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	1.78'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	3'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	6'
DEPTH TOP OF PERVIOUS SECTION	10'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	30'
DEPTH BOTTOM OF SUMP (FT)	35'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	35'
TYPE OF SEAL	Bentonite
ELEV./DEPTH BOTTOM OF SEAL (FT)	50'
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	Bentonite

NOTES: #2 sand 35 to 8 feet; # 00 sand from 8 to 6 feet.
Screened zone amended to 10'-30' based on impacts.

GEI Consultants

Project NG ROCKAWAY

Project No. 2522-141-050

Date 8.23.10

Classified By LL SR.

VISUAL CLASSIFICATION

~ LEVEL "C" HANDLING ~

☒ U.S.C.S.
☐ U.S.D.A.
☐ BURMISTER

BORING NO.	SAMPLE NO.	DEPTH	CLASSIFICATION	REMARKS
RW-16B	ND	50'-52'	Gray f sand, tr. silt (SP-SM)	strong petro. odor
	ND	55'-57'	Gray br. f-m sand, tr. silt (SP)	" " "
	ND	60'-62'	GSD	
	ND	65'-67'	GSD	
	ND	70'-72'	Gray f sand, tr. silt (SP)/(SP-SM)	strong petro. odor
	ND	75'-77'	Gray f sand, tr./little silt (SP-SM)/(SM)	" " "
	ND	80'-82'	Gray f sand, tr. silt (SP-SM)	" " "
	ND	85'-87'	Gray f sand, little silt (SM)	" " " + coating/sheen
	ND	90'-92'	GSD	
	ND	95'-97'	GSD	
	ND	100'-102'	Br. f sand, tr./little silt (SP-SM)/(SM)	strong petro. odor
	ND	105'-107'	Lt. br. & gray f-m sand, tr. silt (SP)	" " "
	ND	110'-112'	GSD	
	ND	115'-117'	Gray f sand, little silt (SM)	strong petro. odor + coating
	ND	118'-120'	GSD	

ND: NOT DESIGNATED.

GSD: SEE ATTACHED GRAIN SIZE DISTRIBUTION & REMARKS

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BORING LOG
PAGE 1 of 6
RW-17B

GROUND SURFACE ELEVATION (FT): 4.73 **LOCATION:**
NORTHING (FT): 151594 **EASTING (FT):** 1030762 **TOTAL DEPTH (FT):** 95.0
DRILLED BY: ADT **DATUM VERT. / HORZ.:** NAVD 88 / NAD 83
LOGGED BY: Devin Byrne **DATE START / END:** 7/30/2012 - 7/31/2012
DRILLING DETAILS: Sonic Coring / Compact RotoSonic 17-C
WATER LEVEL DEPTHS (FT):
GENERAL NOTE: Boring began at 5 feet due to previous cap being installed across site
There was no recovery in the 50'-90' and 90'-95' interval

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	0		60/36	PID= 0.4 ppm				(0'- 1.67') ~15% sand, fine to coarse; 85% blue stone, dark brown.	
				PID= 0.4 ppm					
				PID= 0.2 ppm				(1.67'- 5') ~70% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; 15% blue stone, moderate petroleum-like odor, dark brown.	
				PID= 7.0 ppm			PLO		
0				PID= 119 ppm					
	5		60/48	PID= 87.1 ppm				(5'- 8.96') 10% blue stone.	
				PID= 47.4 ppm					
				PID= 31.5 ppm					
				PID= 24.9 ppm					
								(8.96'- 9.17') ~25% sand, ~5% gravel; 70% crushed blue stone.	
-5								(9.17'- 10') 10% blue stone.	
	10		60/48	PID= 84.3 ppm			NLO	(10'- 10.73') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, wet, gray and black, coated with product; mostly fine sand.	
				PID= 101 ppm					
				PID= 193 ppm				(10.73'- 12.29') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray and black, coated with product.	
				PID= 201 ppm			NLO		
				PID= 242 ppm					
				PID= 267 ppm			NLO	(12.29'- 12.4') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% fines; 10% shell fragments, strong naphthalene-like odor, dark gray and black, coated with product.	
				PID= 233 ppm			NLO	(12.4'- 13.96') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, light gray, coated with product.	
				PID= 241 ppm			NLO	(13.96'- 14.38') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor,	
-10	15						NLO		

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

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BORING LOG

RW-17B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
	15		60/36	PID= 250 ppm PID= 252 ppm PID= 170 ppm			NLO	light gray, coated with product. (14.38'- 15') NARROWLY GRADED SAND WITH SILT (SP-SM); ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, dark gray and black, coated with product.	
				PID= 273 ppm PID= 160 ppm			NLO	(15'- 17.08') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine; strong naphthalene-like odor, black. (17.08'- 18.61') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine; strong naphthalene-like odor, black, lightly coated with product; mostly fine sand.	
				PID= 521 ppm			NLO NLO NLO	(18.61'- 18.89') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine; strong naphthalene-like odor, black, stained; mostly fine sand.	
-15	20		60/60	PID= 92.3 ppm PID= 44.1 ppm PID= 139 ppm PID= 124 ppm PID= 131 ppm PID= 223 ppm PID= 108 ppm PID= 94.4 ppm PID= 203 ppm PID= 79.2 ppm			NLO NLO NLO NLO NLO	(18.89'- 19.44') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine; strong naphthalene-like odor, light gray, lightly coated with product; mostly fine sand. (19.44'- 20') NARROWLY GRADED SAND WITH SILT (SP-SM); ~85% sand, fine to medium, ~10% fines, ~5% gravel, fine; strong naphthalene-like odor, gray, lightly coated with product; mostly fine sand. (20'- 21.33') NARROWLY GRADED SAND WITH SILT (SP-SM); coarse, ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, some staining; mostly fine sand. (21.33'- 21.75') NARROWLY GRADED SAND WITH SILT (SP-SM); coarse, ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, moderately coated with product; mostly fine sand. (21.75'- 22.08') NARROWLY GRADED SAND WITH SILT (SP-SM); coarse, ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, light gray, light staining; mostly fine sand.	
-20	25		60/55	PID= 227 ppm PID= 230 ppm PID= 113 ppm PID= 69.1 ppm PID= 50.2 ppm PID= 212 ppm			NLO NLO NLO NLO	(22.08'- 23.5') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, coarse; 5% shells, strong naphthalene-like odor, light gray, heavily coated with product; mostly fine sand. (23.5'- 25') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~10% gravel, coarse; 5% shells, strong naphthalene-like odor, light gray, moderately coated with product; mostly fine sand. (25'- 25.64') NARROWLY GRADED SAND (SP); ~85% sand, fine to medium, ~5% gravel, coarse, ~5% fines; 5% shells, strong naphthalene-like odor, light gray, moderately coated with product; mostly fine sand. (25.64'- 25.91') NARROWLY GRADED SAND WITH SILT (SP-SM); coarse, ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, light staining; mostly fine sand. (25.91'- 29.09') NARROWLY GRADED SAND WITH SILT (SP-SM); coarse, ~90% sand, fine to medium, ~10% fines; strong naphthalene-like odor, gray, heavily coated with product; mostly fine sand.	
-25	30		120/58	PID= 38.9 ppm PID= 32.0 ppm PID= 5.2 ppm PID= 9.0 ppm			NLO NLO	(29.09'- 30') NARROWLY GRADED SAND WITH SILT (SP-SM); coarse, ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, gray, heavily coated with product; mostly fine sand. (30'- 32.76') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, gray, lightly coated with product. (32.76'- 34.31') WIDELY GRADED SAND (SW); ~90% sand, fine to coarse, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor,	

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BORING LOG
PAGE 3 of 6
RW-17B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 34.4 ppm			NLO	gray, brown staining.	
-30	35			PID= 51.5 ppm			NLO	(34.31'- 36.55') NARROWLY GRADED SAND WITH SILT (SP-SM); ~80% sand, fine to medium, ~10% gravel, fine, ~10% fines; moderate naphthalene-like odor, dark brown, heavily stained and lightly coated with product.	
				PID= 4.1 ppm			NLO	(36.55'- 38.45') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, light gray, lightly coated with product.	
-35	40						NLO	(38.45'- 40') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% gravel, fine, ~5% fines; moderate naphthalene-like odor, light gray, heavily coated with product.	
			120/45	PID= 42.0 ppm				(40'- 43.67') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, gray, mostly fine sand.	
				PID= 15.5 ppm					
				PID= 4.5 ppm			NLO		
				PID= 2.6 ppm				(43.67'- 46.22') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, gray, sporadic areas of staining and lightly coated with product.	
-40	45			PID= 139 ppm			NLO		
							NLO	(46.22'- 46.89') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, light gray, heavily coated.	
							NLO	(46.89'- 47.56') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, light gray, some staining.	
				PID= 95 ppm			NLO	(47.56'- 48.89') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, dark brown, heavily coated with product.	
							NLO	(48.89'- 49.11') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, light gray, some staining.	
-45	50						NLO	(49.11'- 50') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, dark brown, heavily coated with product.	
			120/0					NO RECOVERY	

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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

CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-17B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-50	55								
-55	60		120/60	PID= 453 ppm			NLO	(60'- 63.33') SILTY SAND (SM); ~90% sand, fine to coarse, ~10% fines; strong naphthalene-like odor, gray, lightly coated with product.	
				PID= 570 ppm					
				PID= 228 ppm					
				PID= 200 ppm			NLO	(63.33'- 63.94') WIDELY GRADED SAND (SW); ~80% sand, fine to coarse, ~10% gravel, fine to coarse, ~5% fines; 5% shells, strong naphthalene-like odor, gray.	
-60	65			PID= 120 ppm			NLO	(63.94'- 66.21') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, gray.	
				PID= 75.6 ppm					
				PID= 346 ppm			NLO	(66.21'- 67.42') NARROWLY GRADED SAND (SP); ~90% sand, fine to medium, ~5% fines; 5% shells, strong naphthalene-like odor, gray, stained black and heavily coated with product.	
				PID= 144 ppm					
				PID= 277 ppm			NLO	(67.42'- 69.55') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, gray, some light coating of product; mostly fine sand.	
				PID= 231 ppm					
-65	70			PID= 146 ppm			NLO NLO	(69.55'- 70') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, gray, moderate to heavily coated	

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MLO = MUSTY LIKE ODOR

CITIZENS 2010_ENV/GEO LOG W/SMWC_ROCKAWAY PARK.GPJ_NG GINT DATA TEMPLATE.GDT_11/15/12

GEI Consultants

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455 Winding Brook Road
Glastonbury, CT 06033
(860) 368-5300

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-17B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
				PID= 195 ppm			NLO	with product. (70'- 73.73') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, mostly fine sand; heavily coated with product.	
				PID= 170 ppm					
				PID= 691 ppm					
				PID= 119 ppm					
				PID= 291 ppm					
				PID= 711 ppm			NLO	(73.73'- 75.09') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, mostly fine sand; heavily coated with product.	
				PID= 334 ppm					
-70	75			PID= 180 ppm			NLO	(75.09'- 75.42') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, oily sheen on soil; mostly fine sand; heavily coated with product.	
				PID= 143 ppm			NLO	(75.42'- 77.2') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, mostly fine sand; heavily coated with product.	
				PID= 805 ppm					
				PID= 1017 ppm					
				PID= 647 ppm			NLO	(77.2'- 77.29') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, Saturated with product.	
				PID= 962 ppm			NLO	(77.29'- 78.48') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, oily sheen on soil; mostly fine sand; heavily coated with product.	
				PID= 289 ppm					
				PID= 337 ppm			NLO	(78.48'- 78.64') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, mostly fine sand; heavily coated with product.	
				PID= 336 ppm			NLO	(78.64'- 79.15') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, mostly fine sand; heavily coated with product.	
-75				PID= 785 ppm			NLO	(79.15'- 80') SILTY SAND (SM); ~80% sand, fine to medium, ~20% fines; strong naphthalene-like odor, dark gray, mostly fine sand; heavily coated with product.	
	80			PID= 652 ppm					
			120/112	PID= 302 ppm				(80'- 84.02') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, dark gray, light to moderately coated wit product.	
				PID= 290 ppm					
				PID= 259 ppm					
				PID= 433 ppm					
				PID= 674 ppm					
				PID= 498 ppm			NLO	(84.02'- 85.08') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, dark gray, light to moderately coated wit product.	
-80	85			PID= 1620 ppm				(85.08'- 88.21') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; strong naphthalene-like odor, dark gray, saturated with product.	
				PID= 556 ppm					
				PID= 221 ppm					
				PID= 41.0 ppm					
							NLO	(88.21'- 88.93') SILTY SAND (SM); ~85% sand, fine to medium, ~15%	

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CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

GEI Consultants

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

CLIENT: National Grid
PROJECT: Rockaway Park Former MGP
CITY/STATE: Rockaway Park, New York
GEI PROJECT NUMBER: 093150-4-1401

BORING LOG

RW-17B

ELEV. FT.	DEPTH FT.	SAMPLE INFO: TYPE and NO.	SAMPLE INFO: PEN/REC IN./IN.	SAMPLE INFO: FIELD TEST DATA	STRATA	VISUAL IMPACTS	ODOR	SOIL / BEDROCK DESCRIPTION	WELL DETAILS
-85	90			PID= 45.0 ppm PID= 34.0 ppm			NLO NLO	fines; moderate naphthalene-like odor, black, heavily coated with product. (88.93'- 89.11') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; moderate naphthalene-like odor, light brown with black, stained. (89.11'- 90') SILTY SAND (SM); ~85% sand, fine to medium, ~15% fines; slight naphthalene-like odor, dark brown and light brown, no visual impacts.	
			60/0					NO RECOVERY	
-90	95							End of Boring at 95 feet.	

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ppm = PARTS PER MILLION
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FT. = FEET

NLO = NAPHTHALENE LIKE ODOR
PLO = PETROLEUM LIKE ODOR
TLO = TAR LIKE ODOR
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CrLO= CREOSOTE LIKE ODOR
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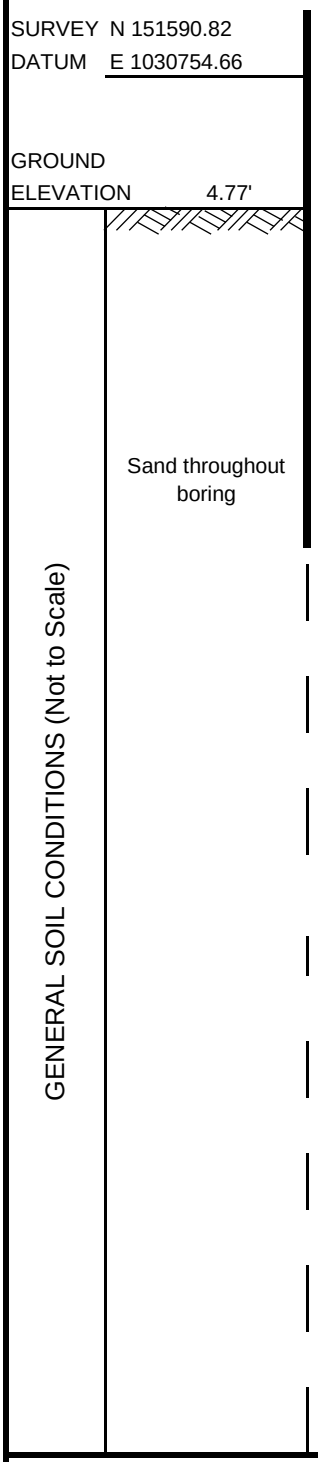
CITIZENS 2010_ENV/GEO LOG W/SMWC ROCKAWAY PARK.GPJ NG GINT DATA TEMPLATE.GDT 11/15/12

RECOVERY WELL INSTALLATION LOG

RW-17A

Project	Rockaway Park Former MGP		
Location	Rockaway Park, NY	PG.	1 OF 1
Client	National Grid	Boring No.	RW-17A
Contractor	Aquifer Drilling & Testing	Driller	Jeremy Meyers
Location	Onsite		
Inspected by	Devin Byrne	Date Started	8/1/12
Checked by	Chris Morris	Date Completed	8/1/2012
Project No.	093150-4-1401		



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	3.00'
ELEVATION OF RISER PIPE	6.42'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	2.0'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	3'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	5'
DEPTH TOP OF PERVIOUS SECTION	10'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	30'
DEPTH BOTTOM OF SAND COLUMN (FT)	35'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 35 to 6.5 feet; # 00 sand from 6.5 to 5 feet.
Well came up ~1.5' when pulling the final 10' auger.

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RECOVERY WELL INSTALLATION LOG

RW-17B

Project	Rockaway Park Former MGP
Location	Rockaway Park, NY
Client	National Grid
Contractor	Aquifer Drilling & Testing
Driller	Jeremy Meyers
Inspected by	Devin Byrne
Date Started	7/30/12
Checked by	Chris Morris
Date Completed	8/1/2012

PG. 1 OF 1

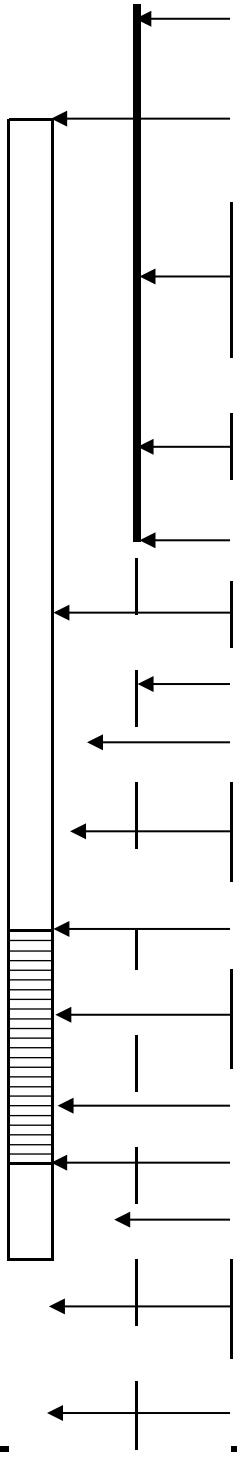
Boring No.	RW-17B
Location	Onsite
Project No.	093150-4-1401

SURVEY N 151593.74
DATUM E 1030761.62

GROUND ELEVATION 4.73'

Sand throughout boring

GENERAL SOIL CONDITIONS (Not to Scale)



LENGTH OF SURFACE CASING ABOVE GROUND SURFACE (FT)	2.90'
ELEVATION OF RISER PIPE	7.32'
THICKNESS OF SURFACE SEAL BELOW GROUND SURFACE, IF ANY (FT)	0.5'
TYPE OF SURFACE SEAL (indicate any additional seals)	concrete
ID OF SURFACE CASING (IN)	8"
TYPE OF SURFACE CASING	Steel
DEPTH BOTTOM OF CASING (FT)	2.1'
RISER PIPE DIAMETER(IN)	4"
TYPE OF RISER PIPE	Sch 40 PVC
DIAMETER OF BOREHOLE (IN)	8"
TYPE OF BACKFILL AROUND RISER PIPE	Grout
DEPTH TOP OF SEAL, IF ANY (FT)	65'
TYPE OF SEAL	Bentonite
DEPTH BOTTOM OF SEAL (FT)	67'
DEPTH TOP OF PERVIOUS SECTION	70'
TYPE OF PERVIOUS SECTION	sch 40 PVC
DESCRIBE OPENINGS	0.020 slot
PERVIOUS SECTION DIAMETER (IN)	4"
TYPE OF BACKFILL AROUND PERVIOUS SECTION	#2 Sand
DEPTH BOTTOM OF PERVIOUS SECTION (FT)	90'
DEPTH BOTTOM OF SUMP (FT)	95'
ELEV./DEPTH TOP OF SEAL, IF ANY (FT)	
TYPE OF SEAL	None
ELEV./DEPTH BOTTOM OF SEAL (FT)	
TYPE OF BACKFILL BELOW PERVIOUS SECTION, IF ANY	None

NOTES: #2 sand 95 to 68 feet; # 00 sand from 68 to 67 feet.

GEI Consultants

APPENDIX E – EXCAVATION WORK PLAN (EWP)

E-1 NOTIFICATION

At least 60 days prior to the start of any activity that is anticipated to encounter MGP-related impacts on the On-Site Property or the Off-Site Property, the Site owner or their representative will notify the NYSDEC and National Grid (if the property is not owned by National Grid). **Table E-1** includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B of the SMP.

Table E-1: Notifications*

Sydney Sobol, NYSDEC Project Manager	(518) 402-4799 Sydney.sobol@dec.ny.gov

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

All intrusive activities must be approved by NYSDEC. Sufficient notification must be made to NYSDEC so they can make the decision on the type of reporting. Typically, the type of notification and reporting requirements depend on the scope of work. Large scale intrusive work may require a detailed work plan, such as a Remedial Action Work Plan while smaller scale intrusive activities may require a Notice of Intrusion letter or a simple letter work plan.

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 On-Site Property and/or Off-Site Property re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of soil with MGP-related impacts to be excavated and any work that may impact an 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 compounds of concern, potential presence of grossly impacted media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix I of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

E-2 SOIL SCREENING METHODS

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

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused within the Site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Section E-6 and E-7 of this Appendix.

E-3 SOIL STAGING METHODS

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

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

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained by National Grid's qualified environmental professional and available for inspection by the NYSDEC.

E-4 MATERIALS EXCAVATION AND LOAD-OUT

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

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

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

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

A truck wash will be operated on the Site, as appropriate. The qualified environmental professional 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 of off-site in an appropriate manner.

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

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

E-5 MATERIALS TRANSPORT OFF-SITE

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

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

The NYC DOT approved truck routes are provided on **Figure 10** of the SMP. 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; and (f) overall safety in transport.

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

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

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

E-6 MATERIALS DISPOSAL OFF-SITE

All material excavated and removed from the Site will be treated as MGP 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 removed for development purposes), a formal request with an associated plan will be made to the NYSDEC. Unregulated off-site management of materials from this Site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e. hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, C/D recycling facility, etc. Actual disposal quantities and

associated documentation will be reported to the NYSDEC in the Periodic Review Report. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading and facility receipts.

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

E-7 MATERIALS REUSE ON-SITE

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on the Site. On-site material, including historic fill and soil with MGP-related impacts, that is acceptable for reuse within the 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.

Material that meets the Unrestricted SCOs listed in Table 375-6.8(a) of 6 NYCRR Part 375 or the Restricted Use SCOs listed in Table 375-6.8(b) of 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 semi-volatile organic compounds (SVOCs) via EPA Method 8270, polychlorinated biphenyls (PCBs) via EPA Method 8082, Total Petroleum Hydrocarbons (TPH) via EPA Method 8015, and total cyanide via EPA Method 9010/9014.

Any demolition material proposed for reuse will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing 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.

Soils proposed for reuse will be segregated in separate stockpiles from soils to be shipped off-site for disposal.

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on the Site.

E-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. 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.

Liquids from decontamination of equipment and personnel will be pumped into storage tanks (such as fractionalization (frac) tanks) and disposed of off site. A licensed liquid waste hauler will remove this liquid from the Site and properly dispose of this material in accordance with all applicable regulations. Solid material collected in the frac tank, as a result of settling, will be bulked with soils and sent to an appropriately licensed disposal facility, as necessary.

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

E-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities, the cover system will be restored in a manner that complies with the ROD, Final Engineering Report, and the 100% Remedial Design Report and Field Change Request 8 which governed the initial installation at the property and/or the Consent Order by National Grid. The specific minimum cover system requirements are listed below.

- On-Site Soil Cover System:
  - A demarcation layer consisting of a Marafi 135N geotextile placed over the compacted subgrade and native materials.
  - A minimum of 18 inches of clean well-graded sandy soil meeting the Unrestricted Use SCOs in 6NYCRR 375-6.7(d).
  - 6-inches of 2.5-inch crushed stone.
- Off-Site Composite Cover System:
  - A demarcation layer consisting of a Marafi 135N geotextile placed over the compacted subgrade and native materials; and,
  - A minimum of 6 inches of clean soil meeting the Restricted Residential Use SCOs in 6NYCRR 375-6.7(d) covered with Asphalt or Concrete; or,
  - A minimum of 24 inches of clean soil meeting the Restricted Residential Use SCOs in 6NYCRR 375-6.7(d).

In areas outside of the Cover Systems, a demarcation layer, consisting of orange snow fencing material or equivalent material will be placed to provide a visual reference to the top of the 'Remaining MGP-Related Impacts Zone', the zone that requires adherence to special conditions for disturbance of remaining MGP-related impacted soils defined in the SMP.

If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining MGP-related impacted soils.

The property owner for the Off-Site Property shall not change the type of cover system following excavation without prior written permission from National Grid. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in any updates to the SMP.

E-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the Site will be approved by the qualified environmental professional and the NYSDEC project manager and will be in compliance with provisions in this SMP prior to receipt at 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 Unrestricted 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 this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

At a minimum, backfill samples will be analyzed for Resource Conservation and Recovery Act (RCRA) 8 Metals, PCBs by EPA Method 8082, VOCs by EPA Method 8260 or New York State Analytical Service Protocol (NYSASP) Method 95.1, and SVOCs by EPA Method 8270C or NYSASP Method 95-2.

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

E-11 STORMWATER POLLUTION PREVENTION

Barriers and hay bale checks will be installed 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 by National Grid's qualified environmental professional and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

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

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

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

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

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

E-12 EXCAVATION CONTINGENCY PLAN

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction,

excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

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

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

In the event that potential MGP-related impacts are encountered at unexpected depth or locations, activities will be suspended and National Grid will be notified and will evaluate the observed conditions and cooperate with the property owner and/or developer to minimize any delays to the extent reasonably feasible. National Grid may determine that laboratory testing is required to evaluate the observed impacts for chemical concentrations and characteristics. If the encountered materials are determined to be associated with MGP materials, then the materials will be segregated and stockpiled for disposal.

E-13 COMMUNITY AIR MONITORING PLAN

A site-specific CAMP was prepared for the Site as part of the SMP. The CAMP is included in Appendix J of the SMP for reference purposes. The CAMP is in compliance with DER-10 and all other applicable Federal, State, and local regulations. Based on future changes to State and Federal health and safety requirements, and specific methods

employed by future contractors, the CAMP will be updated and re-submitted for NYSDEC approval.

The CAMP will be designed to provide monitoring procedures, Alert Levels, Response Levels, Action Levels, and contingency measures if Action Levels are approached. Alert Levels are not established by the NYSDOH or NYSDEC and are National Grid internally established concentration levels for Total VOCs only. An Alert Level is a contaminant concentration or odor intensity that triggers contingent measures. An Alert Limit does not suggest the existence of a health hazard, but serves instead as a screening tool to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants and odors during intrusive activities. A Response Level is a contaminant concentration level that triggers a temporary work stoppage, continued monitoring, reporting, and potential contingent measures. An Action Limit is a contaminant concentration or odor intensity that triggers work stoppage.

During times of ground intrusive activities, fence line perimeter air monitoring will be conducted using a combination of real-time (continuous and almost instantaneous) air monitoring at fixed locations and walk-around supplemental monitoring using hand-held instruments on an as-needed basis. Contaminants commonly found at former MGP sites will be monitored, including VOCs and dust. The CAMP will include a plan that defines Alert Levels, Response Levels, Action Levels, and specific response activities to be implemented during working hours if an exceedance of an Alert Level, Response Level, or Action Level for a measured compound occurs. The response actions, potentially including work stoppage, are intended to prevent or significantly reduce the migration of airborne contaminants from the Site.

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

E-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. If nuisance odors are identified at the On-Site Property or Off-Site Property boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

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

E-15 DUST CONTROL PLAN

A dust suppression plan that addresses dust management during invasive 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 Property and Off-Site Property roads will be limited in total area to minimize the area required for water truck sprinkling.

E-16 OTHER NUISANCES

A plan for rodent control will be developed and utilized by the contractor prior to and during Site clearing and Site grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX F – QUALITY ASSURANCE PROJECT PLAN

GEI Consultants

Consulting
Engineers and
Scientists

Quality Assurance Project Plan

Rockaway Park Site

Borough of Queens
Rockaway Park, New York
Site ID # 2-41-029
NYSDEC Consent Index No. D1-0002-98-11

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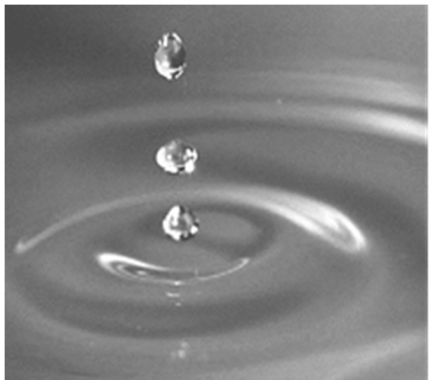

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Attachment

A Test America Buffalo Laboratory Quality Manual (electronic only)

Abbreviations and Acronyms

%R	Percent Recovery
ASP	Analytical Service Protocol
ASTM	American Society for Testing and Materials
CAS	Chemical Abstract Service
CHMM	Certified Hazardous Materials Manager
CMS	Chip Measurement System
CLP	Contract Laboratory Protocol
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
eV	Electron Volt
FSP	Field Sampling Plan
GC/MS	Gas Chromatography/Mass Spectroscopy
GEI	GEI Consultants, Inc., P.C.
LCS	Laboratory Control Sample
LEL	Lower Explosive Limit
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MS	Matrix Spike
MSD	Matrix Spike Duplicate
NAPL	Non-Aqueous Phase Liquids
NYSDEC	New York State Department of Environmental Conservation
OM&M	Operations, Maintenance and Monitoring
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
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
RSD	Relative Standard Deviation
SD	Standard Deviation
SMP	Site Management Plan
SOP	Standard Operating Procedures
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compounds
TOX	Total Organic Halides
USDOT	United States Department of Transporation

VOC	Volatile Organic Compound

MEASUREMENTS

mg/kg	milligrams per kilogram
µg /L	micrograms per liter
µg /m^3	micrograms per cubic meter

Quality Assurance Glossary

"Alteration" means altering a sample collected for analysis in any way other than by adding a preservative, such as nitric acid to lower pH. Examples of alteration include, but are not limited to: filtering, settling and decanting, centrifuging and decanting and acid extracting.

"Analytical Services Protocol" or "ASP" means the New York State Department of Environmental Conservation (NYSDEC's) compendium of approved United States Environmental Protection Agency (EPA) and NYSDEC laboratory methods for sample preparation and analysis and data handling procedures.

"Correlation Sample" means a sample taken, when using a field-testing technology, to be analyzed by an ELAP-certified laboratory to determine the correlation between the laboratory and field analytical results.

"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 New York State Department of Health, which certifies environmental laboratories through on-site inspections and evaluation of principles of credentials and proficiency testing.

"Filtration" means the filtering of a groundwater or surface water sample, collected for metals analysis, at the time of collection and prior to preservation. Filtering includes, but is

not limited to, the use of any membrane, fabric, paper or other filter medium, irrespective of pore size, to remove particulates from suspension.

"**Final delineation sample**" means a sample taken as an endpoint sample, used to make a decision regarding the extent of contamination at a site, which is to be analyzed by an ELAP-certified laboratory.

"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.

"Minimum reporting limit" means the lowest concentration at which an analyte can be detected and which can be reported with a reasonable degree of accuracy. It is the lowest concentration that can be measured, a lab-specific number, developed from minimum detection limits, and is also referred to as the practical quantitation limit (PQL).

"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.

"Nephelometric Turbidity Unit" or "NTU" is the unit by which turbidity in a sample is measured.

"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.

"Preservation" means preventing the degradation of a sample due to precipitation, biological action, or other physical/chemical processes between the time of sample collection and analysis. The most common examples involve refrigeration at 4 degrees Celsius and lowering sample pH by the addition of acid to keep dissolved metals in solution or to reduce the biodegradation of dissolved organic analytes.

"PAH" means polycyclic aromatic hydrocarbon as defined by EPA Method 8270.

"Quality assurance" or "QA" 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" or "QC" means the routine application of procedures for attaining prescribed standards of performance in the monitoring and measurement process.

"Semivolatile organic compound" or "SVOC" 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 2005 ASP.

"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 TCL+30 scan means the analysis of a sample for TCL compounds and up to 10 non-targeted volatile organic compounds and up to 20 non-targeted SVOCs 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 chemical compound that is not on the target compound list but is detected in a sample analyzed by a GC/MS analytical method. TICs are only possible with methods using mass spectrometry as the detection technique. The compound is tentatively identified using a mass spectral instrumental electronic library search and the concentration of the compound estimated.

"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" or "VOC" means organic compounds amenable to analysis by the purge and trap technique. For the purposes of this chapter, analysis of VOCs means the analysis of a sample for either those priority pollutants listed as amenable for analysis using EPA method 8260B 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.

"Well development" means the application of energy to a newly installed well to establish a good hydraulic connection between the well and the surrounding formation. During development, fine-grained formation material that may have infiltrated the sand pack and/or well during installation is removed, allowing water from the formation to enter the well without becoming turbid and unrepresentative of groundwater in the formation.

1. Purpose

GEI Consultants, Inc., P.C. (GEI) has prepared this Quality Assurance Project Plan (QAPP) to address analytical sampling and operations, maintenance and monitoring (OM&M) activities at the Rockaway Park Site located in Rockaway Park, New York. This plan accounts for current sampling as well as potential future sampling. The QAPP is a companion document to the *Site Management Plan*. The QAPP presents the project scope and goals, organization, objectives, sample handling procedures and quality assurance/quality control (QA/QC) procedures associated with the Rockaway Park Site.

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, as necessary, so they can be applied to developing a conceptual understanding of the nature and extent of contamination of soils and groundwater at the Rockaway Park Site
- All aspects of investigation, from field to laboratory, are documented to provide data that are technically sound and legally defensible
- The site cap and cover system is inspected regularly and certified on an annual basis

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.* NYSDEC. *May 3, 2010;*
- *Analytical Service Protocol,* NYSDEC. *July 2005;*
- *US EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5, March 2001); and*
- *Guidance for Quality Assurance Project Plans (EPA QA/G-5, December 2002).*

2. Project Goals and Objectives

National Grid has completed active remediation at the site. However, the Remedial Action Objectives (RAOS) have not yet been achieved at the site and remaining contamination was left in the subsurface at the site.

The remedy for the Rockaway Park Site is to treat contaminated groundwater that is likely to migrate from the site and to remove mobile non-aqueous phase liquids (NAPL). Specifically, continued remedial efforts will entail:

- **NAPL Recovery**: Passive recovery wells are installed in OU-1 to remove mobile NAPL from the subsurface.
- **Groundwater Monitoring**: Groundwater Monitoring will continue in accordance with the NYSDEC-approved sampling criteria to evaluate the effectiveness of the remedy.

3. Project Organization and Responsibility

GEI is responsible for the implementation of the scope of work associated with the OM&M plan, Site Management Plan (SMP), and associated performance monitoring tasks including the supervision of contractors, field activities, and the evaluation and interpretation of data. GEI will perform 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: David Terry
Program Manager: Errol Kitt
Project Managers: Matt O'Neil
Field Team Leader: Michael Quinlan
GEI Corporate Health & Safety Officer: Steven Hawkins, Master of Public Health, PhD(c), Certified Hazardous Materials Manager (CHMM)
Data Validators: Lorie Mackinnon, Lisa McDonagh
Quality Assurance Officer/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	Errol Kitt	• Overall program oversight • Project management • Project schedule • Client contact regarding project-related issues • Personnel and resource management • Review of project submittals • Budgeting
Project Manager	Matt O'Neil	• Client contact regarding project related issues • Coordination of contractors • Technical development and implementation of OM&M Plan, SMP, Work Plan, and Field Sampling Plan • Personnel and resource management • Preparation and review of project submittals • Preparation of project submittals • Budgeting
Field Team Leader	Michael Quinlan	• Client contact regarding project related issues on day to day basis as part of field operations

Key Project Personnel and Responsibilities		
Position	**GEI Personnel**	**Areas of Responsibilities**
		• Coordination of contractors • Implementation of OM&M Plan, Work Plan and Field Sampling • Plan Personnel and resource management • Preparation of project submittals
Data Validators	Lorie MacKinnon Lisa McDonagh	• Perform data validation activities • Prepare data usability summary reports • Evaluate data with regards to quality objectives
Quality Assurance Officer/Data Manager	Brian Skelly Jaime Wargo	• Manage raw data from the laboratory • Maintain copies of COCs in the project file • QA/QC for sampling, validation and laboratory performance

Test America Laboratory of Buffalo, New York, has been selected to perform the following standard analytical chemistry parameters for subsurface soil and groundwater samples which may include:

- Volatile Organic Compounds (VOCs) according to EPA Method 8260B
- Semi-Volatile Organic Compounds (SVOCs) according to EPA Method 8270C
- Target Analyte List (TAL) Metals according to EPA Method 6010B/7470A/7471B series
- Polychlorinated Biphenyls (PCBs) and pesticides by EPA Method 8082A
- Herbicides by EPA Method 8151A
- Total Cyanide by EPA Method 9012
- Sulfate by EPA Method 375.2
- Heterotrophic Plate Count according to American Society for Testing and Materials (ASTM) Method 9215B
- Biological Oxygen Demand by SM5210B
- Total Organic Carbon by SM5310 (aqueous) and Lloyd Kahn (solids)
- Ammonia by EPA Method 350.1
- Nitrogen by EPA Method 351.2
- Nitrate/Nitrite by EPA Method 353.3
- Disposal Parameters including:
    - Toxicity Characteristic Leaching Procedure (TCLP) constituents including VOCs by EPA 8260B, SVOCs by EPA 8270, Resource Conservation and Recovery Act (RCRA)-8 Metals by EPA 6000/7000 series, pesticides by EPA Method 8081, and herbicides by EPA Method 8151A
    - pH by EPA Method 150.1
    - Reactive cyanide by EPA method 7.3.3.2 (2)

- Reactive sulfide by EPA Method 7.3.4.1 (2)
- Total Organic Halides (TOX) by EPA Method 9020B
- Total Petroleum Hydrocarbons by EPA 8100/418.1
- Total cyanide EPA 9010
- Percent sulfur by EPA D129-64
- BTU content by ASTM D240-87
- Flash point by EPA Method 1010
- Percent moisture and density

Test America's relevant certifications are summarized in the following table.

Test America's 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 Protocol (CLP) CLP-Lab: 10023
United States	United States Environmental Protection Agency	EPA Lab Code: NY00044 [VOCs/SVOCs/Inorganics]

Table 1 provides a summary of soil analyses and **Table 2** provides a summary of groundwater analyses. **Table 3** 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 (MDL), reporting limit (RL), 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.

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, groundwater, and soil vapor from the former MGP operations, compared to New York State Standards, Criteria and Guidance values, and 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 and the Field Sampling Plan (FSP) included in Appendix I of the SMP.

The data quality indicators are presented in subsections 4.1 through 4.6. Procedures to assess the data quality indicators are given below in Section 13.

Table 4 and **Table 5** provide the RLs, MDLs and the DQOs for soil and groundwater samples. The DQOs for soil samples for this project include minimum RLs specified within the 2005 NYSDEC Analytical Services Protocol (ASP) as well as unrestricted use criteria listed in Title 6 of the Compilation of the Rules and Regulations of the State of New York Part 375 (6 NYCRR Part 375). The DQOs for groundwater samples for this project include minimum RLs specified within the 2005 NYSDEC ASP as well as Class GA groundwater criteria listed in the Division of Water Technical and Operational Guidance Series 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations dated June 1998 and associated errata and addendums.

Tables 6 and **Table 7** provide the precision and accuracy DQOs for soil and water samples.

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 MDL 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 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. The 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.

Tables 4 and **Table 5** provide the reporting limits and the DQOs for soil and groundwater samples.

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 **Attachment 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 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 below in subsection 13.2. The resulting information will be used to assess sampling and analytical variability. Duplicate samples are described below in subsection 5.1.5. **Table 3** 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 twenty primary samples per matrix. Duplicate samples are described below in subsection 5.1.5. **Table 3** 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.

4.5 Representativeness

Representativeness is a qualitative parameter that expresses the degree to which data accurately and precisely represents 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 any future work plans and the current OM&M plan 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.

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 any future work plan as well as the current OM&M plan is 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., milligrams per kilogram (mg/kg)]); for liquids (weight/unit volume [i.e., micrograms per liter (µg/L)]); for air (weight/unit volume [i.e., micrograms per cubic meter (µg/m^3)]);
- Use common chemical name with corresponding chemical abstract system (Chemical Abstracts Service [CAS]) code; and
- Report all data for soils on a dry-weight basis.

5. Sampling Plan

Environmental sampling will include soil, groundwater, 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 in future work plans. Sampling methods and procedures are presented in the FSP.

5.1 Sample Type, Location, and Frequency

5.1.1 Subsurface Soil Samples

If subsurface soil samples are required, field conditions at the time of sampling will determine the appropriate method. Possible methods include Geoprobe®, hollow-stem auger, or other appropriate drilling methods. The depth, location and number of soil borings will be specified in a job-specific Work Plan. Soil samples will be collected and submitted for laboratory analysis in general accordance with the job-specific Work Plan and FSP. A summary of typical subsurface soil sample naming analysis is provided in **Table 1**.

5.1.2 Groundwater samples

The current monitoring well network will be gauged and sampled in accordance with the OM&M Plan. If additional monitoring wells are needed, specifications will be outlined in a job-specific Work Plan. Groundwater samples will be collected and submitted for laboratory analysis in general accordance with the SMP, OM&M Plan, and/or the job-specific Work Plan. Water quality parameters including temperature, pH, turbidity, salinity, dissolved oxygen (DO) oxidation reduction potential, and specific conductance, will be collected prior to laboratory analysis. A summary of groundwater samples and analysis depicted is provided in **Table 2**.

5.1.3 Investigation-Derived Waste Sample Collection

Waste classification sampling will be conducted for any future soil 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 (i.e. drums) 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 at a rate and for parameters that are required by the National Grid-approved disposal facility.

5.1.4 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 3**.

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 a 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 containing samples submitted for VOC analysis.

Field Duplicate Samples, also referred to as blind duplicate samples, are two samples that are submitted from 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 3** 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 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. Sample preservation and containerization details are outlined in **Table 3**.

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
- 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 COC

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 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. 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 project manager for completeness and representativeness. When necessary, logbooks will be supported by daily activity reports.

6.1.2 COC Records

Sample custody is discussed in detail below in subsection 6.2. COC records are initiated by the samplers in the field. The field portion of the custody documentation should include:

- The project name
- The project number
- Signature(s) of sampler (s) responsible for sample custody
- Sample Name/ID number
- Date and time of collection
- Whether the sample is grab or composite
- Names of individuals involved in sampling
- Required analytical methods
- 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 COC 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 an 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 SAMPLE TYPES	QA/QC SAMPLE TYPES
SOIL SAMPLES	**FIELD BLANKS**
Boring-ID (SAMPLE DEPTH-FEET)	SAMPLE-ID – [DATE]
RPSB-01 (10-15)	RPSB-FB-020117
GROUNDWATER SAMPLES	RPMW-FB-020117
Monitoring Well-ID	RPGW-FB-020117
RPMW-01	RPSS-FB-020117
Temporary Groundwater Monitoring Point-ID	**MATRIX SPIKE/DUP**
(SAMPLE DEPTH-FEET)	SAMPLE [ID] [DEPTH] [EITHER MS OR MSD]
RPGW-01 (10-15)	RPSB-01 (10-15) MS/MSD
SOIL SAMPLES	RPMW-01 MS/MSD
Surface Soil-ID (SAMPLE DEPTH-FEET)	RPGW-01 (10-15) MS/MSD
RPSS-01 (0-0.5)	RPSS-01 (0-0.5) MS/MSD
	TRIP BLANKS
	SAMPLE- ID [DATE]
	RPTB-020117
	BLIND DUPLICATES
	SAMPLE-ID[XX][DATE]
	RPSB-XX-020117
	RPMW-XX-020117
	RPGW-XX-020117
	RPSS-XX-020117

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 Project QA Officer.

6.1.4 Sample Handling

Samples will be handled in general accordance with the FSP.

6.2 Sample Custody

The COC 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 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 COC and packaging procedures are summarized below. These procedures will ensure that the samples will arrive at the laboratory with the COC 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 naming system is presented above in subsection 6.1.3.
- Sample labels will be completed for each sample using waterproof ink.
- Samples will be accompanied by a completed COC form. The sample numbers and locations will be listed on the COC 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 COC record identifying the contents. The original record will accompany the shipment, and copies will be retained by the sampler and provided to the data manager 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 COC 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 COC 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 COC records
- Compare samples received against those listed on the COC
- 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 COC forms
- Sign and date the COC 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 COC, air bills, and any additional documentation will be placed in the project 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, at a minimum. If concentrations of VOCs are encountered above the reference gas standard, the soil screening photoionization detector (PIDs) 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 may be used during sampling activities.

Subsurface Soil Sampling Activities:

- RAE Systems MultiRAE Plus equipped with VOC (10.6 electron volt [eV] lamp); lower explosive limit (LEL), percent oxygen, hydrogen sulfide, and hydrogen cyanide, or equivalent
- RAE Systems MiniRAE 2000 (PID) with 10.6 eV lamp or equivalent
- Drager Chip Measurement System (CMS) and compound specific chips (including benzene, naphthalene, hydrogen cyanide, etc.) or equivalent
- TSI DustTrak DRX 8533 (particulate monitor) or equivalent

Groundwater Sampling Activities:

- Horiba U22 or equivalent

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.

The laboratory quality plan for Test America is located in **Attachment A**.

8. Sample Preparation and Procedures

Analytical samples will be collected in general accordance with the FSP and as specified in a job specific Work Plan. **Table 1 and Table 2** provide sample collection matrices for soil and groundwater. Analytical samples will be collected into laboratory-preserved sample containers and will be preserved as indicated in **Table 3**.

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. Complete data packages suitable for data validation to support the generation of a DUSR according to NYSDEC requirements will be provided by the project data validator Ms. Elissa M. McDonagh. Data Management will be performed under the direction of Jaimie Wargo Senior Technician – Data Management.

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 project manager 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 USEPA CLP National Functional Guidelines for Organic Data Review (January 2005) and the USEPA 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 3 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.

Laboratory deliverables will consist of an original hard copy data package that is in general accordance with NYSDEC ASP Category B data deliverable requirements for data packages that require validation. Data validation is required for:

- 20-percent of OM&M groundwater samples; or
- As specified in a job specific Work Plan.

The laboratory will provide a data package that is in general accordance with NYSDEC ASP Category A data deliverable requirements for data packages that do not require validation.

Data validation will be completed by the consultants' data validators or qualified contracted personnel. Data validation frequency for analytical samples collected outside of OM&M activities will be specified in a job specific Work Plan. 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 between the laboratory's RL and the MDL; 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 Deliverable

Laboratory deliverables will consist of an original hard copy data package that is in general accordance with NYSDEC ASP Category B data deliverable requirements when validation is requested. The laboratory will provide a deliverable in accordance with NYSDEC ASP Category A data deliverable when validation is not required.

10. Internal Quality Control

Laboratory and field quality internal control checks will be used to ensure the data quality objectives are achieved. At a minimum, this will include:

- MS and/or MS/MSDs 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

Field quality control samples will include:

- Equipment blanks as outlined in **Table 3**
- Field duplicate samples as outlined in **Table 3**
- Trip blanks as outlined in **Table 3**
- MS/MSDs as outlined in **Table 3**

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. Preventative Maintenance

Preventative maintenance will be performed on field equipment in accordance with the manufacturer's recommendations. Preventative maintenance to field equipment will be provided by equipment vendors U.S Environmental Rental Corporation, Pine Environmental Services, or other selected vendors.

Laboratory equipment calibration and maintenance procedures are specified in Test America's laboratory quality manual located in **Attachment 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:

$$MDL = (t[n-1,1-a=0.99]) \times (s)$$

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.

The RL is determined as follows:

$$PQL = \frac{Lowest\ conc.\ std\ (ng)}{Volume\ injected\ (uL)}\ x\ \frac{Sample\ aliquot\ (mL\ or\ g)}{Final\ volume\ (mL)}\ x\ DF\ x\ \frac{100}{(100 - PM)}$$

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 = | first measurement - second measurement |

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:

$$Bias = pH_m - pH_t$$

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.

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. It is anticipated that 95-percent of the data will be complete. Data validation criteria discussed in 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 FSP and job-specific 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 and the 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 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 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 Project 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

Corrective action in the laboratory will be completed in accordance with the quality assurance procedures located in **Attachment 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. Soil and Sediment Field Sampling Matrix
Rockaway Park Site
Far Rockaway, New York

Sample I.D.	TYPICAL SOIL & SEDIMENT BORING SAMPLE SELECTION RATIONALE: 1. Shallow soil/sediment within observed impacts (0 to 5' bgs). 2. Subsurface soil/sediment within heaviest observed impacts below 5 feet (if present). 3. Subsurface soil/sediment below deepest observed visual impacts. 4. Refer to job specific Work Plan and Field Sampling Plan for specific sampling details. IF NO IMPACTS ARE OBSERVED IN BORING: 1. 30, 60, and 90' bgs.								Analysis			
	Sample Number											
	Number Samples Proposed	Number Samples Collected	Date Collected	0 to 5' bgs	Heaviest Impacted Zone below 5 feet (if Present)	Water Table Interface	Subsurface soil/sediment below deepest observed visual impacts	Completion depth of boring	VOCs (EPA Method 8260B)	TAL Metals (EPA Method 6000/7000)	TBD	TBD
Subsurface Soil												
RPSB-XX	TBD								X	X		

Notes:

VOCs - Volatile Organic Compounds
TAL - Target Analyte List
TBD - To Be Determined
BGS - Below Ground Surface

Table 2. Groundwater Field Sampling Matrix
Rockaway Park Site
Far Rockaway, New York

Sample I.D.	Sample Location	SAMPLE SELECTION RATIONALE: 1. Groundwater Sample locations and depth intervals will be specified within a job specific Work Plan				Water Quality Measurements							Analysis										
		Sample Number			Sample Zone	pH	Specific Conductance	Temperature	Oxidation Reduction Potential (ORP)	Turbidity	Salinity	Dissolved Oxygen (DO)	VOCs (EPA Method 8260B)	Chemical Oxygen Demand (COD)	Biological Oxygen Demand (BOD)	Nitrate/Nitrite (EPA Method 353.3)	Sulfate (SO4)	TAL Metals (EPA Method 6000/7000)	Hydrogen (H2)	Methane (CH4)	Ferrous (Fe2+)	Total Organic Carbon (TOC)	Dehalococcoides and Dehalococcoides Ethenogenes
		Number Samples Proposed	Number Samples Collected	Date Collected	Water Table																		
Monitoring Well Sample Locations																							
RPMW-XX	TBD					X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Notes:

VOCs - Volatile Organic Compounds
TAL - Target Analyte List
TBD - To Be Determined
BGS - Below Ground Surface

Table 3. Analytical Methods/Quality Assurance Summary Table
Rockaway Park Site
Far Rockaway, New York

Media	Number of Primary Samples	QA/QC Samples				Total Number of Samples	Analytical Parameters	Method	Preservative	Holding Time	Container
		TB	FB[1]	DUP	MS/MSD						
Subsurface Soil	TBD	1/Cooler	1/20	1/20	1/20	TBD	VOCs	8260B	Cool to 4°C	5 days unpreserved, 12 days preserved	Terra Core or En Core
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TAL Metals	6010B/7471B	Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	Wide mouth 8-oz. clear glass jar
Ground Water	TBD	1/Cooler	1/20	1/20	1/20	TBD	VOCs	8260B	pH<2 with HCl, Cool to 4°C	5 days unpreserved, 12 days preserved	(2) 40 mL VOA vials w/HCL
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Sulfate	375.2	NaOH + Zn Acetate, Cool to 4°C	26 days	(1) 250 mL Polyethylene container / (1) 1000 mL Polyethylene container w/NaOH + Zn Acetate
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Nitrogen	351.2	H2SO4 Cool to 4°C	26 days	(1) 250 mL amber glass w/H2SO4
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Nitrate/Nitrite	353.3	Cool to 4°C	24 hours	(1) 250 mL Polyethylene container
	TBD	1/Cooler	1/20	1/20	1/20	TBD	Ammonia	350.1	H2SO4 , Cool to 4°C	26 days	(1) 250 mL amber glass w/H2SO4
	TBD	1/Cooler	1/20	1/20	1/20	TBD	TAL Metals	6010B/7470A	HNO3, Cool to 4°C	28 days to analysis for mercury; 6 months to analysis for other metals	(1) 500 mL Polyethylene container w/HNO3

Notes:

[1]: Soil field blanks will include bottles listed in groundwater section of the table.

Waste Characterization disposal sample analysis will meet the requirements of the selected disposal facility.

TBD - To Be Determined

VOCs - volatile organic compounds

TAL - Target Analyte List

VOA - Volatile Organic Analysis

°C- Degrees Celsius

oz. - ounce

mL - Milliliter

HNO3 - Nitric acid

NaOH - Sodium Hydroxide

HCl - Hydrochloric Acid

H2SO4 - Sulfuric Acid

Zn - Zinc

Table 4. Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
Rockaway Park Site
Far Rockaway, New York

CAS Number	Analyte	DQO's		Test America Labs[2]	
		ASP 2005	Unrestricted Use[1]		
		CRQL (ug/mg)	SCO (mg/kg)	RL (mg/kg)	MDL (mg/kg)
Volatile Organic Compounds Method 8260 B (mg/kg)					
67-64-1	Acetone	10	0.05	0.025	0.00421
107-13-1	Acrylonitrile	100	NE	0.025	0.00448
71-43-2	Benzene	10	0.06	0.005	0.000245
74-97-5	Bromochloromethane	10	NE	0.005	0.000361
75-27-4	Bromodichloromethane	10	NE	0.005	0.00067
75-25-2	Bromoform	10	NE	0.005	0.0025
74-83-9	Bromomethane	10	NE	0.005	0.00045
78-93-3	2-Butanone (MEK)	10	0.12	0.025	0.00183
75-15-0	Carbon disulfide	10	100*	0.005	0.0025
56-23-5	Carbon tetrachloride	10	0.76	0.005	0.000484
108-90-7	Chlorobenzene	10	1.1	0.005	0.00066
75-00-3	Chloroethane	10	NE	0.005	0.00113
110-75-8	2-Chloroethylvinylether	10	NE	0.01	0.0025
67-66-3	Chloroform	10	0.37	0.005	0.000309
74-87-3	Chloromethane	10	NE	0.005	0.000302
124-48-1	Dibromochloromethane	10	NE	0.005	0.00064
96-12-8	1,2-Dibromo-3-chloropropane	100	NE	0.005	0.0025
106-93-4	1,2-Dibromoethane (EDB)	10	NE	0.005	0.000642
95-50-1	1,2-Dichlorobenzene	10	1.1	0.005	0.000391
541-73-1	1,3-Dichlorobenzene	10	2.4	0.005	0.000257
106-46-7	1,4-Dichlorobenzene	10	1.8	0.005	0.0007
110-57-6	trans-1,4-dichloro-2-butene	100	NE	0.005	0.00113
75-34-3	1,1-Dichloroethane	10	0.27	0.005	0.00061
107-06-2	1,2-Dichloroethane	10	0.02	0.005	0.000251
75-35-4	1,1-Dichloroethene	10	0.33	0.005	0.000612
156-59-2	cis-1,2-Dichloroethene	10	0.25	0.005	0.00064
156-60-5	trans-1,2-Dichloroethene	10	0.19	0.005	0.000516
75-09-2	Methylene chloride	10	0.05	0.005	0.0023
78-87-5	1,2-Dichloropropane	10	NE	0.005	0.0025
10061-01-5	cis-1,3-Dichloropropene	10	NE	0.005	0.00072
10061-02-6	trans-1,3-Dichloropropene	10	NE	0.005	0.0022
100-41-4	Ethylbenzene	10	1	0.005	0.000345
591-78-6	Methyl Butyl Ketone (2-Hexanone)	10	NE	0.025	0.0025
74-88-4	Iodomethane	10	NE	0.005	0.000243
108-10-1	4-Methyl-2-pentanone (MIBK)	10	NE	0.025	0.00164
100-42-5	Styrene	10	NE	0.005	0.00025
79-34-5	1,1,2,2-Tetrachloroethane	10	35*	0.005	0.000811
630-20-6	1,1,1,2-Tetrachloroethane	10	NE	0.005	0.0005
127-18-4	Tetrachloroethene	10	1.3	0.005	0.000671
108-88-3	Toluene	10	0.7	0.005	0.000378
71-55-6	1,1,1-Trichloroethane	10	0.68	0.005	0.000363
79-00-5	1,1,2-Trichloroethane	10	NE	0.005	0.00065
79-01-6	Trichloroethene	10	0.47	0.005	0.0011
75-69-4	Trichlorofluoromethane (FREON 11)	10	NE	0.005	0.000473
96-18-4	1,2,3-Trichloropropane	10	80*	0.005	0.000509
108-05-4	Vinyl acetate	10	NE	0.01	0.00251
75-01-4	Vinyl chloride	10	0.02	0.005	0.00061
108383/106423	m,p-Xylene	NA	NE	0.01	0.00084
95-47-6	o-Xylene	NA	NE	0.005	0.000653
1330-20-7	Total Xylene	10	0.26	0.01	0.00084
107-05-1	Allyl chloride (3-Chloropropene)	10	NE	0.005	0.0024
75-71-8	Dichlorodifluoromethane (FREON 12)	10	NE	0.005	0.000413
98-82-8	Isopropyl benzene (Cumene)	10	NE	0.005	0.000754
91-20-3	Naphthalene	10	12	0.005	0.00067
103-65-1	n-Propylbenzene (Propylbenzene)	10	3.9	0.005	0.0004
120-82-1	1,2,4-Trichlorobenzene	10	NE	0.005	0.000304
95-63-6	1,2,4-Trimethylbenzene	10	3.6	0.005	0.00096
108678/622968	1,3,5-Trimethylbenzene/P-ethyltoluene	10	8.4	0.005	0.000322
106-99-0	1,3-Butadiene	NE	NE	0.005	0.000492
123-91-1	1,4-Dioxane	NE	0.1	0.1	0.0218
540-84-1	2,2,4-Trimethylpentane (iso-Octane)	NE	NE	0.005	0.0006
67-63-0	2-Propanol (Isopropyl alcohol)	NE	NE	NA	NA
75-07-0	Acetaldehyde	NE	NE	NA	NA
25168-05-2	Chlorotoluene	NE	NE	NA	NA
110-82-7	Cyclohexane	NE	NE	0.005	0.0007
64-17-5	Ethanol (Ethyl Alcohol)	NE	NE	0.1	0.0836
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	NE	100*	0.005	0.00114
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	NE	NE	NA	NA

Table 4. Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
Rockaway Park Site
Far Rockaway, New York

CAS Number	Analyte	DQO's		Test America Labs[2]	
		ASP 2005	Unrestricted Use[1]		
		CRQL (ug/mg)	SCO (mg/kg)	RL (mg/kg)	MDL (mg/kg)
142-82-5	n-Heptane (Heptane)	NE	NE	0.1	0.0027
110-54-3	n-Hexane (Hexane)	NE	NE	0.05	0.0029
1634-04-4	Methyl tert-butyl ether (MTBE)	NE	0.93	0.005	0.000491
109-99-9	Tetrahydrofuran	NE	NE	0.01	0.0029
Semivolatile Organic Compounds (mg/kg) via Method 8270 C					
83-32-9	Acenaphthene	330	20	0.17	0.025
208-96-8	Acenaphthylene	330	100	0.17	0.022
120-12-7	Anthracene	330	100	0.17	0.042
56-55-3	Benz[a]anthracene	330	1	0.17	0.017
205-99-2	Benzo[b]fluoranthene	330	1	0.17	0.027
207-08-9	Benzo[k]fluoranthene	330	0.8	0.17	0.022
191-24-2	Benzo[g,h,i]perylene	330	100	0.17	0.018
50-32-8	Benzo[a]pyrene	330	1	0.17	0.025
100-51-6	Benzyl alcohol	330	NE	0.33	0.023
85-68-7	Butyl benzyl phthalate	330	100*	0.17	0.028
111-91-1	Bis(2-chloroethoxy)methane	330	NE	0.17	0.036
111-44-4	Bis(2-chloroethyl)ether	330	NE	0.17	0.022
117-81-7	Bis(2-ethylhexyl)phthalate	330	50*	0.17	0.058
101-55-3	4-Bromophenyl phenyl ether	330	NE	0.17	0.024
106-47-8	4-Chloroaniline	330	200*	0.17	0.42
59-50-7	4-Chloro-3-methylphenol	330	NE	0.17	0.042
91-58-7	2-Chloronaphthalene	330	NE	0.17	0.028
95-57-8	2-Chlorophenol	330	400*	0.17	0.031
7005-72-3	4-Chlorophenyl phenyl ether	330	NE	0.17	0.021
218-01-9	Chrysene	330	1	0.17	0.038
53-70-3	Dibenz[a,h]anthracene	330	0.33	0.17	0.03
132-64-9	Dibenzofuran	330	7	0.17	0.02
84-74-2	Di-n-butyl phthalate	330	100*	0.17	0.029
95-50-1	1,2-Dichlorobenzene	330	1.1	0.33	0.023
541-73-1	1,3-Dichlorobenzene	330	2.4	0.33	0.2
106-46-7	1,4-Dichlorobenzene	330	1.8	0.33	0.026
91-94-1	3,3-Dichlorobenzidine	660	NE	0.33	0.2
120-83-2	2,4-Dichlorophenol	330	2*	0.17	0.018
84-66-2	Diethyl phthalate	330	100*	0.17	0.022
51-28-5	2,4-Dinitrophenol	800	200*	1.66	0.784
131-11-3	Dimethyl phthalate	330	100*	0.17	0.02
534-52-1	4,6-Dinitro-2-methylphenol	800	NE	0.33	0.17
105-67-9	2,4-Dimethylphenol	330	NE	0.17	0.041
121-14-2	2,4-Dinitrotoluene	330	NE	0.17	0.035
606-20-2	2,6-Dinitrotoluene	330	NE	0.17	0.02
117-84-0	Di-n-octyl phthalate	330	100*	0.17	0.02
206-44-0	Fluoranthene	330	100	0.17	0.018
86-73-7	Fluorene	330	30	0.17	0.02
118-74-1	Hexachlorobenzene	330	0.33	0.17	0.023
87-68-3	Hexachlorobutadiene	330	NE	0.17	0.025
77-47-4	Hexachlorocyclopentadiene	330	NE	0.17	0.023
67-72-1	Hexachloroethane	330	NE	0.17	0.022
193-39-5	Indeno[1,2,3-cd]pyrene	330	0.5	0.17	0.021
78-59-1	Isophorone	330	100*	0.17	0.036
91-57-6	2-Methylnaphthalene	330	NE	0.17	0.034
95-48-7	2-Methylphenol (o-Cresol)	330	0.33	0.17	0.02
106-44-5	4-Methylphenol (p-Cresol)	330	0.33	0.33	0.02
91-20-3	Naphthalene	330	12	0.17	0.022
88-74-4	2-Nitroaniline	800	NE	0.33	0.025
99-09-2	3-Nitroaniline	800	NE	0.33	0.047
100-01-6	4-Nitroaniline	800	NE	0.33	0.089
98-95-3	Nitrobenzene	330	3.7*	0.17	0.019
88-75-5	2-Nitrophenol	330	NE	0.17	0.048
100-02-7	4-Nitrophenol	800	NE	0.33	0.119
62-75-9	N-Nitrosodimethylamine	330	NE	0.33	0.072
86-30-6	N-Nitrosodiphenylamine	330	NE	0.17	0.138
621-64-7	N-Nitrosodi-n-propylamine	330	NE	0.17	0.029
52438-91-2	2,2-oxybis[1-Chloropropane]	330	NE	0.17	0.034
87-86-5	Pentachlorophenol	800	0.8	0.33	0.17
85-01-8	Phenanthrene	330	100	0.17	0.025
108-95-2	Phenol	330	0.33	0.17	0.026
129-00-0	Pyrene	330	100	0.17	0.02
120-82-1	1,2,4-Trichlorobenzene	330	NE	0.33	0.024
95-95-4	2,4,5-Trichlorophenol	330	NE	0.17	0.046

Table 4. Chemical Parameters, Reporting Limits and Data Quality Objectives for Soil Samples
Rockaway Park Site
Far Rockaway, New York

CAS Number	Analyte	DQO's		Test America Labs[2]	
		ASP 2005	Unrestricted Use[1]		
		CRQL (ug/mg)	SCO (mg/kg)	RL (mg/kg)	MDL (mg/kg)
88-06-2	2,4,6-Trichlorophenol	330	NE	0.17	0.034
86-74-8	Carbazole	330	NE	0.17	0.02

Notes:

ug/mg - micrograms per milligram
mg/kg - milligrams per kilogram
RL - Reporting Limits
MDL - Method Detection Limit
DQO - Data Quality Objectives
ASP - Analytical Service Protocol
CRQL - Contract Required Quantitation Limit
SCO - Site Clean-up Objective
1 - DQOs are based on 6 NYCRR Part 375 Unrestricted Use Soil Clean-up Objectives
2 - RLs and MDLs are based on Test America's Reporting Limits and Method Detection limits as of February 2017. They are subject to change.
* - Guidance came from SSCO's listed in the NYSDEC DRAFT Soil Cleanup Guidance (November 4, 2009)
Bolding - Does not meet the DQO

Table 5. Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
Rockaway Park Site
Far Rockaway, New York

CAS Number	Analyte	DQO's		Test America Labs[2]	
		ASP 2005	NY AWQS GA[1]		
		CRQL (ug/L)	H(WS) (ug/L)	RL (ug/L)	MDL (ug/L)
Volatile Organic Compounds Method 8260 B (ug/L)					
67-64-1	Acetone	5	50*	**10**	3
107-13-1	Acrylonitrile	10	5	5	0.83
71-43-2	Benzene	1	1	1	0.41
74-97-5	Bromochloromethane	1	5	1	0.87
75-27-4	Bromodichloromethane	1	50*	1	0.39
75-25-2	Bromoform	1	50*	1	0.26
74-83-9	Bromomethane	1	5	1	0.69
78-93-3	2-Butanone (MEK)	5	50*	**10**	1.32
75-15-0	Carbon disulfide	1	60*	1	0.19
56-23-5	Carbon tetrachloride	1	5	1	0.27
108-90-7	Chlorobenzene	1	5	1	0.75
75-00-3	Chloroethane	1	5	1	0.32
110-75-8	2-Chloroethylvinylether	1	NE	**5**	0.96
67-66-3	Chloroform	1	7	1	0.34
74-87-3	Chloromethane	1	5	1	0.35
124-48-1	Dibromochloromethane	1	50*	1	0.32
96-12-8	1,2-Dibromo-3-chloropropane	1	0.04	**1**	**0.39**
106-93-4	1,2-Dibromoethane (EDB)	1	0.0006	**1**	**0.73**
95-50-1	1,2-Dichlorobenzene	1	3	1	0.79
541-73-1	1,3-Dichlorobenzene	1	3	1	0.78
106-46-7	1,4-Dichlorobenzene	1	3	1	0.84
110-57-6	trans-1,4-dichloro-2-butene	1	5	1	0.22
75-34-3	1,1-Dichloroethane	1	5	1	0.38
107-06-2	1,2-Dichloroethane	1	NE	1	0.21
75-35-4	1,1-Dichloroethene	1	0.07	**1**	**0.29**
156-59-2	cis-1,2-Dichloroethene	1	5	1	0.81
156-60-5	trans-1,2-Dichloroethene	1	5	1	0.9
75-09-2	Methylene chloride	2	5	1	0.44
78-87-5	1,2-Dichloropropane	1	1	1	0.72
10061-01-5	cis-1,3-Dichloropropene	1	0.4	**1**	0.36
10061-02-6	trans-1,3-Dichloropropene	1	0.4	**1**	0.37
100-41-4	Ethylbenzene	1	5	1	0.74
591-78-6	Methyl Butyl Ketone (2-Hexanone)	5	50*	5	1.24
74-88-4	Iodomethane	1	5	1	0.3
108-10-1	4-Methyl-2-pentanone (MIBK)	5	NE	5	2.1
100-42-5	Styrene	1	5	1	0.73
79-34-5	1,1,2,2-Tetrachloroethane	1	5	1	0.21
630-20-6	1,1,1,2-Tetrachloroethane	1	5	1	0.35
127-18-4	Tetrachloroethene	1	5	1	0.36
108-88-3	Toluene	1	5	1	0.51
71-55-6	1,1,1-Trichloroethane	1	5	1	0.82
79-00-5	1,1,2-Trichloroethane	1	1	1	0.23
79-01-6	Trichloroethene	1	5	1	0.46
75-69-4	Trichlorofluoromethane (FREON 11)	1	5	1	0.88
96-18-4	1,2,3-Trichloropropane	1	0.04	**1**	**0.89**
108-05-4	Vinyl acetate	1	NE	5	0.85
75-01-4	Vinyl chloride	1	2	1	0.9
108383/106423	m,p-Xylene	NA	5	2	0.66
95-47-6	o-Xylene	NA	5	1	0.76
1330-20-7	Total Xylene	1	5	**2**	0.66
107-05-1	Allyl chloride (3-Chloropropene)	10	5	1	0.44
75-71-8	Dichlorodifluoromethane (FREON 12)	1	5	1	0.68
98-82-8	Isopropyl benzene (Cumene)	1	5	1	0.79
91-20-3	Naphthalene	1	10**	1	0.43
103-65-1	n-Propylbenzene (Propylbenzene)	1	5	1	0.69
120-82-1	1,2,4-Trichlorobenzene	1	5	1	0.41
95-63-6	1,2,4-Trimethylbenzene	1	5	1	0.75
108678/622968	1,3,5-Trimethylbenzene/P-ethyltoluene	1	NE	1	0.77
106-99-0	1,3-Butadiene	NE	NE	5	0.28
123-91-1	1,4-Dioxane	NE	NE	40	9.32
540-84-1	2,2,4-Trimethylpentane (iso-Octane)	NE	NE	5	0.23
67-63-0	2-Propanol (Isopropyl alcohol)	NE	NE	10	1.7
75-07-0	Acetaldehyde	NE	8*	NA	NA
25168-05-2	Chlorotoluene	NE	5	NA	NA
110-82-7	Cyclohexane	NE	NE	1	0.18
64-17-5	Ethanol (Ethyl Alcohol)	NE	NE	50	34.3
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	NE	5	1	0.31
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	NE	NE	NA	NA

Table 5. Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
Rockaway Park Site
Far Rockaway, New York

CAS Number	Analyte	DQO's		Test America Labs[2]	
		ASP 2005	NY AWQS GA[1]		
		CRQL (ug/L)	H(WS) (ug/L)	RL (ug/L)	MDL (ug/L)
142-82-5	n-Heptane (Heptane)	NE	NE	20	0.42
110-54-3	n-Hexane (Hexane)	NE	NE	10	0.4
1634-04-4	Methyl tert-butyl ether (MTBE)	NE	10*	1	0.16
109-99-9	Tetrahydrofuran	NE	50*	5	1.25
Semivolatile Organic Compounds (ug/kg) via Method 8270 C					
83-32-9	Acenaphthene	10	20**	5	0.41
208-96-8	Acenaphthylene	10	NE	5	0.38
120-12-7	Anthracene	10	50*	5	0.28
56-55-3	Benz[a]anthracene	10	0.002*	**5**	**0.36**
205-99-2	Benzo[b]fluoranthene	10	0.002*	**5**	**0.34**
207-08-9	Benzo[k]fluoranthene	10	0.002*	**5**	**0.73**
191-24-2	Benzo[g,h,i]perylene	10	NE	5	0.35
50-32-8	Benzo[a]pyrene	10	ND	5	0.47
100-51-6	Benzyl alcohol	10	NE	20	2
85-68-7	Butyl benzyl phthalate	10	50*	5	1
111-91-1	Bis(2-chloroethoxy)methane	10	5	5	0.35
111-44-4	Bis(2-chloroethyl)ether	10	1	**5**	0.4
117-81-7	Bis(2-ethylhexyl)phthalate	10	5	5	2.2
101-55-3	4-Bromophenyl phenyl ether	10	NE	5	0.45
106-47-8	4-Chloroaniline	10	5	5	0.59
59-50-7	4-Chloro-3-methylphenol	10	NE	5	0.45
91-58-7	2-Chloronaphthalene	10	10**	5	0.46
95-57-8	2-Chlorophenol	10	NE	5	0.53
7005-72-3	4-Chlorophenyl phenyl ether	10	NE	5	0.35
218-01-9	Chrysene	10	0.002*	**5**	**0.33**
53-70-3	Dibenz[a,h]anthracene	10	NE	5	0.42
132-64-9	Dibenzofuran	10	NE	10	0.51
84-74-2	Di-n-butyl phthalate	10	50	5	0.31
95-50-1	1,2-Dichlorobenzene	10	3	**10**	0.4
541-73-1	1,3-Dichlorobenzene	10	3	**10**	0.48
106-46-7	1,4-Dichlorobenzene	10	3	**10**	0.46
91-94-1	3,3-Dichlorobenzidine	20	5	5	0.4
120-83-2	2,4-Dichlorophenol	10	5	5	0.51
84-66-2	Diethyl phthalate	10	50*	5	0.22
51-28-5	2,4-Dinitrophenol	25	10*	10	2.22
131-11-3	Dimethyl phthalate	10	50*	5	0.36
534-52-1	4,6-Dinitro-2-methylphenol	25	NE	10	2.2
105-67-9	2,4-Dimethylphenol	10	50*	5	0.5
121-14-2	2,4-Dinitrotoluene	10	5	5	0.447
606-20-2	2,6-Dinitrotoluene	10	5	5	0.4
117-84-0	Di-n-octyl phthalate	10	50*	5	0.47
206-44-0	Fluoranthene	10	50*	5	0.4
86-73-7	Fluorene	10	50*	5	0.36
118-74-1	Hexachlorobenzene	10	0.04	**5**	**0.51**
87-68-3	Hexachlorobutadiene	10	0.5	**5**	**0.68**
77-47-4	Hexachlorocyclopentadiene	10	5	5	0.59
67-72-1	Hexachloroethane	10	5	5	0.59
193-39-5	Indeno[1,2,3-cd]pyrene	10	0.002*	**5**	**0.47**
78-59-1	Isophorone	10	50*	5	0.43
91-57-6	2-Methylnaphthalene	10	NE	5	0.6
95-48-7	2-Methylphenol (o-Cresol)	10	1**	**5**	0.4
106-44-5	4-Methylphenol (p-Cresol)	10	1**	**10**	0.36
91-20-3	Naphthalene	10	10**	5	0.76
88-74-4	2-Nitroaniline	25	5	**10**	0.42
99-09-2	3-Nitroaniline	25	5	**10**	0.48
100-01-6	4-Nitroaniline	25	5	**10**	0.25
98-95-3	Nitrobenzene	10	0.4	**5**	0.29
88-75-5	2-Nitrophenol	10	NE	5	0.48
100-02-7	4-Nitrophenol	25	NE	10	1.52
62-75-9	N-Nitrosodimethylamine	10	NE	10	2.2
86-30-6	N-Nitrosodiphenylamine	10	50*	5	0.51
621-64-7	N-Nitrosodi-n-propylamine	10	NE	5	0.54
52438-91-2	2,2-oxybis[1-Chloropropane]	10	NE	5	0.52
87-86-5	Pentachlorophenol	25	1**	**10**	**2.2**
85-01-8	Phenanthrene	10	50*	5	0.44
108-95-2	Phenol	10	1**	**5**	0.39
129-00-0	Pyrene	10	50*	5	0.34
120-82-1	1,2,4-Trichlorobenzene	10	5	**10**	0.44
95-95-4	2,4,5-Trichlorophenol	10	NE	5	0.48

Table 5. Chemical Parameters, Reporting Limits and Data Quality Objectives for Groundwater Samples
Rockaway Park Site
Far Rockaway, New York

CAS Number	Analyte	DQO's		Test America Labs[2]	
		ASP 2005	NY AWQS GA[1]		
		CRQL (ug/L)	H(WS) (ug/L)	RL (ug/L)	MDL (ug/L)
88-06-2	2,4,6-Trichlorophenol	10	NE	5	0.61
86-74-8	Carbazole	10	NE	5	0.3
Inorganic Analytes (ug/L)					
7429-90-5	Aluminum	NE	NE	200	60
7440-36-0	Antimony	60	3	**20**	**6.79**
7440-38-2	Arsenic	10	25	**15**	5.55
7440-39-3	Barium	200	1000	2	0.7
7440-41-7	Beryllium	5	3*	2	0.3
7440-43-9	Cadmium	5	5	2	0.5
7440-70-2	Calcium	NE	NE	500	100
7440-47-3	Chromium (sum of Cr III and Cr IV)	10	50	4	1
7440-48-4	Cobalt	50	NE	4	0.63
7440-50-8	Copper	25	200	10	1.6
7439-89-6	Iron	NE	300	50	19.3
7439-92-1	Lead	5	25	**10**	3
7439-95-4	Magnesium	NE	35000*	200	43.4
7439-96-5	Manganese	NE	300	3	0.4
7439-97-6	Mercury	0.2	0.7	0.2	0.12
7440-02-0	Nickel	40	100	10	1.26
7440-09-7	Potassium	NE	NE	500	100
7782-49-2	Selenium	5	10	**25**	**8.7**
7440-22-4	Silver	10	50	6	1.7
7440-23-5	Sodium	NE	20000	1000	324
7440-28-0	Thallium	10	0.5*	**20**	**10.2**
7440-62-2	Vanadium	50	NE	5	1.5
7440-66-6	Zinc	20	2000*	10	1.5
Wet Chemistry (ug/L)					
NA	Biological Oxygen Demand			2000	2000
NA	Chemical Oxygen Demand			2000	2000
14797-55-8	Nitrate			50	20
14797-65-0	Nitrite			50	20
14808-79-8	Sulfate			5000	1500
18496-25-8	Sulfide			1000	670
7440-44-0	Total Organic Carbon			1000	434
74-82-8	Methane			4	1

Notes:

ug/L - milligrams per Liter
RL - Reporting Limit
MDL - Method Detection Limit
DQO - Data Quality Objectives
ASP - Analytical Service Protocol
CRQL - Contract Required Quantitation Limit
NY AWQS - New York Ambient Water Quality Standards
1 - DQOs are based on TOGS Ambient Water Quality Standards and Guidance Values and Groundwater
2 - RLs and MDLs are based on Test America's Reporting Limits and Method Detection limits as of February 2017. They are subject to change.
* - Guidance Value
** - NY AWQS are for the GA water class designated as type Health (Water Source) [H(WS)]. If the H(WS) designation was not available, the Aesthetic [E] type is used shown.
Bolding - Does not meet the DQO

Table 6. Quality Control Limits Precision and Accuracy for Soil and Sediment Samples
Rockaway Park Site
Far Rockaway, New York

Analytical	Analytical Method	MS/MSD Compound	MS/MSD % Recovery			LCS % Recovery		Surrogate	Surrogate % Recovery	
			Low	High	RPD	Low	High		Low	High
VOCs	8260B	1,1-Dichloroethene	61	145	14	61	145	1,2-Dichloroethane-d4	33	145
		Benzene	76	127	11	76	127	4-Bromofluorobenzene	60	148
		Chlorobenzene	75	130	13	75	130	Toluene-d8	60	132
		Toluene	76	125	13	76	125			
		Trichloroethene	71	120	14	71	120			
Metals	6010B	Metals excluding Hg	75[(a)]	125	20[(b)]	Varies	Varies	NA		
	7470A	Mercury	75[(a)]	125	20[(b)]	NA		NA		

Notes:

MS - Matrix Spike
MSD - Matrix Spike Duplicate
LCS - Laboratory Control Sample
(a) - Matrix spike only
(b) - Laboratory duplicate RPD
NA - Not Applicable
VOCs - volatile organic compounds
RPD - Relative Percent Difference

Table 7. Quality Control Limits Precision and Accuracy for Groundwater Samples
Rockaway Park Site
Far Rockaway, New York

Analytical	Analytical Method	MS/MSD Compound	MS/MSD % Recovery			LCS % Recovery		Surrogate	Surrogate % Recovery	
			Low	High	RPD	Low	High		Low	High
VOCs	8260B	1,1-Dichloroethene	61	145	14	61	145	1,2-Dichloroethane-d4	56	140
		Benzene	76	127	11	76	127	4-Bromofluorobenzene	79	145
		Chlorobenzene	75	130	13	75	130	Toluene-d8	75	166
		Toluene	76	125	13	76	125			
		Trichloroethene	71	120	14	71	120			
Metals	6010B	Metals excluding Hg	75[(a)]	125	20[(b)]	80	120	NA		
	7470A	Mercury	75[(a)]	125	20[(b)]	NA		NA		
Wet Chemistry	353.3	Nitrite	75[(a)]	125	20[(b)]	80	120	NA		
	353.3	Nitrate	75[(a)]	125	20[(b)]	90	110	NA		
	375.2	Sulfate	75[(a)]	125	20[(b)]	80	120	NA		
	SM4500-P E	Total Phosphorus	75[(a)]	125	20[(b)]	80	120	NA		
	351.2	Total Kjeldahl Nitrogen	75[(a)]	125	20[(b)]	80	120	NA		
	SM4500-NH3 H	Ammonia	75[(a)]	125	20[(b)]	80	120	NA		
	SM4500-NC	Total Nitrogen	NA					NA		
	SM5210B	Biological Oxygen Demand	NA	NA	NA	84.5	115.5	NA		
	410.4	Chemical Oxygen Demand	75[(a)]	125	20[(b)]	80	120	NA		
	SM5310B	Total Organic Carbon	75[(a)]	125	20[(b)]	80	120	NA		
		Hydrogen	75[(a)]	125	20[(b)]	80	120	NA		
	ASTM Method D3872-86	Ferrous Iron	75[(a)]	125	20[(b)]	80	120	NA		
	RSK-175	Methane (dissolved gases)	41	156	40	41	156	Propene	40	176

Notes:

MS - Matrix Spike
MSD - Matrix Spike Duplicate
LCS - Laboratory Control Sample
(a) Matrix spike only
(b) Laboratory duplicate RPD
NA - Not Applicable
VOCs - volatile organic compounds
RPD - Relative Percent Difference

Attachment A

Test America Buffalo Quality Assurance Manual (electronic only)

Cover Page:

Quality Assurance Manual

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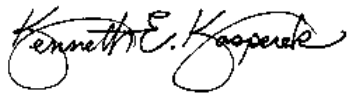

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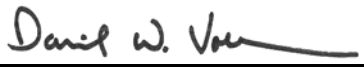

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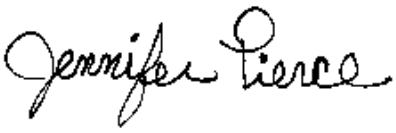

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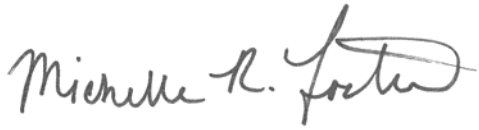

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Facilities Manager – Ken Kinecki

10/05/2016
Date

SECTION 2

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REFERENCED CORPORATE SOPs AND POLICIES

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SOP / Policy Reference	Title
CA-I-P-002	Electronic Reporting and Signature Policy
CA-L-P-002	Contract Compliance Policy
CW-L-S-004	Subcontracting Procedures
CA-Q-M-002	Corporate Quality Management Plan
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-006	Detection Limits
CA-Q-S-009	Root Cause Analysis
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health & Safety Manual
CW-F-P-002	Company-Wide Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization
CW-L-P-004	Ethics Policy
CW-L-S-002	Internal Investigation
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CW-Q-S-003	Internal Auditing
CW-Q-S-004	Management Systems Review
CW-Q-S-005	Data Recall Process
CA-C-S-001	Work Sharing Process

REFERENCED LABORATORY SOPs

SOP Reference	Title
BF-GP-001	Calibration of Autopipettes and Repipetters
BF-GP-002	Support Equipment: Maintenance, Record Keeping and Corrective Actions
BF-GP-005	Sample Homogenization and Subsampling
BF-GP-012	Technical Data Review
BF-GP-013	Manual Integration
BF-GP-015	Record Storage and Retention
BF-GP-018	Strict Internal Chain or Custody
`BF-GP-019	Standard Traceability and Preparation

BF-GP-020	Thermometer Calibration
BF-PM-001	Project Information Requirements
BF-PM-003	Bottle Order Set-up
BF-PM-005	Correctness of Analysis
BF-PM-008	Massachusetts DEP Notification Procedures
BF-QA-001	Determination of Method Detection Limits
BF-QA-002	Quality Control Limits
BF-QA-003	Procedure for Writing, Reviewing and Revising Controlled Documents
BF-QA-004	Laboratory Personnel Training
BF-QA-005	Preventative and Corrective Action
BF-QA-006	Data Quality Review
BF-SR-001	Cooler Shipping - Bottle Kits and Samples
BF-SR-002	Receipt of Analytical Samples

- The full list of Laboratory SOPs is maintained in the Quality Assurance Department
- The full list of analytical methods performed in the Laboratory is can be exported from the Laboratory Information Management System's Total Access Database

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SECTION 3

INTRODUCTION, SCOPE AND APPLICABILITY

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Buffalo'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 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards, The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025(E) 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 CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- ANSI/ASQC, E4-1994, "Specifications and Guidelines for Quality Management Systems for Environmental Data Collection and Environmental Technology Programs" (American National Standard, January 5, 1995, or most recent version)
- "EPA Requirements for Quality Management Programs" (QA/R-2) (EPA/240/B-01/002, May 31, 2006).
- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- 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.
- Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition September 1986, Final Update I, July 1992, Final Update II A, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261. New York State Analytical Services Protocol, July 2005
- Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005).
- Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th, and on-line Editions. 21st.

- *U.S. Department of Energy* Order 414.1B, *Quality Assurance*, Approved April 29, 2004.
- *U.S. Department of Energy* Order 414.1C, *Quality Assurance*, June 17, 2005.
- *U.S. Department of Energy Order 414.1D, Quality Assurance, Aril, 25, 2011.*
- Toxic Substances Control Act (TSCA).

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 and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests 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 Section 19.0. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these 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

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. The manual itself is reviewed every two years 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 BF-QA-003)

SECTION 4

MANAGEMENT REQUIREMENTS

4.1 OVERVIEW

TestAmerica Buffalo 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. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President and Chief Executive Officer (CEO), Chief Operating Officer (COO), Executive VP Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Buffalo 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 Additional Requirements for Laboratories

The responsibility for quality resides 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 Buffalo laboratory.

4.2.2 Laboratory Director

TestAmerica Buffalo'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.

The Laboratory Director has the authority to affect those policies and procedures to ensure that only data of the highest level of excellence are produced. As such, the Laboratory Director is responsible for maintaining a working environment which encourages open, constructive problem solving and continuous improvement.

Specific responsibilities include, but are not limited to:

- Provides one or more department managers for the appropriate fields of testing. If the Department Manager 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 Department Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary NELAP 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.
- Leads the management team, consisting of the QA Manager, the Technical Manager, and the Operations Manager as direct reports.

4.2.3 Quality Assurance (QA) Manager or Designee

The QA manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and their Corporate Quality Director. 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 department to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- 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.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- 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, data authenticity 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 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 shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitor standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a subset 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, evaluate manual 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.
- Leads the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.

- 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 12.

- Evaluation of the thoroughness and effectiveness of training.

- Compliance with ISO 17025.

4.2.4 Technical Manager or Designee

The Technical Manager(s) report(s) directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision and for compliance with the ISO 17025 Standard. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.

- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from "cradle to grave," insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc..
- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.

4.2.5 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. He/She reports directly to the Laboratory Director. He/She assists the Technical Manager in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Manager and QA Manager and in compliance with regulatory requirements.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.6 Department Managers

Department Managers report to the Operations Manager. The Department Managers serve as the technical experts on assigned projects, provide technical liaison, assist in resolving any technical issues within the area of their expertise; and implement established policies and procedures to assist the Operations Manager in achieving section goals. 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, and 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 Human Resources

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 Manager, 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, Technical Manager, Operations Manager, and/or 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.

4.2.7 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.

4.2.8 Environmental Health & Safety Coordinator

The Environmental Health and Safety Coordinator 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 Safety Data Sheet (SDS) 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.

4.2.9 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 Manager, 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.

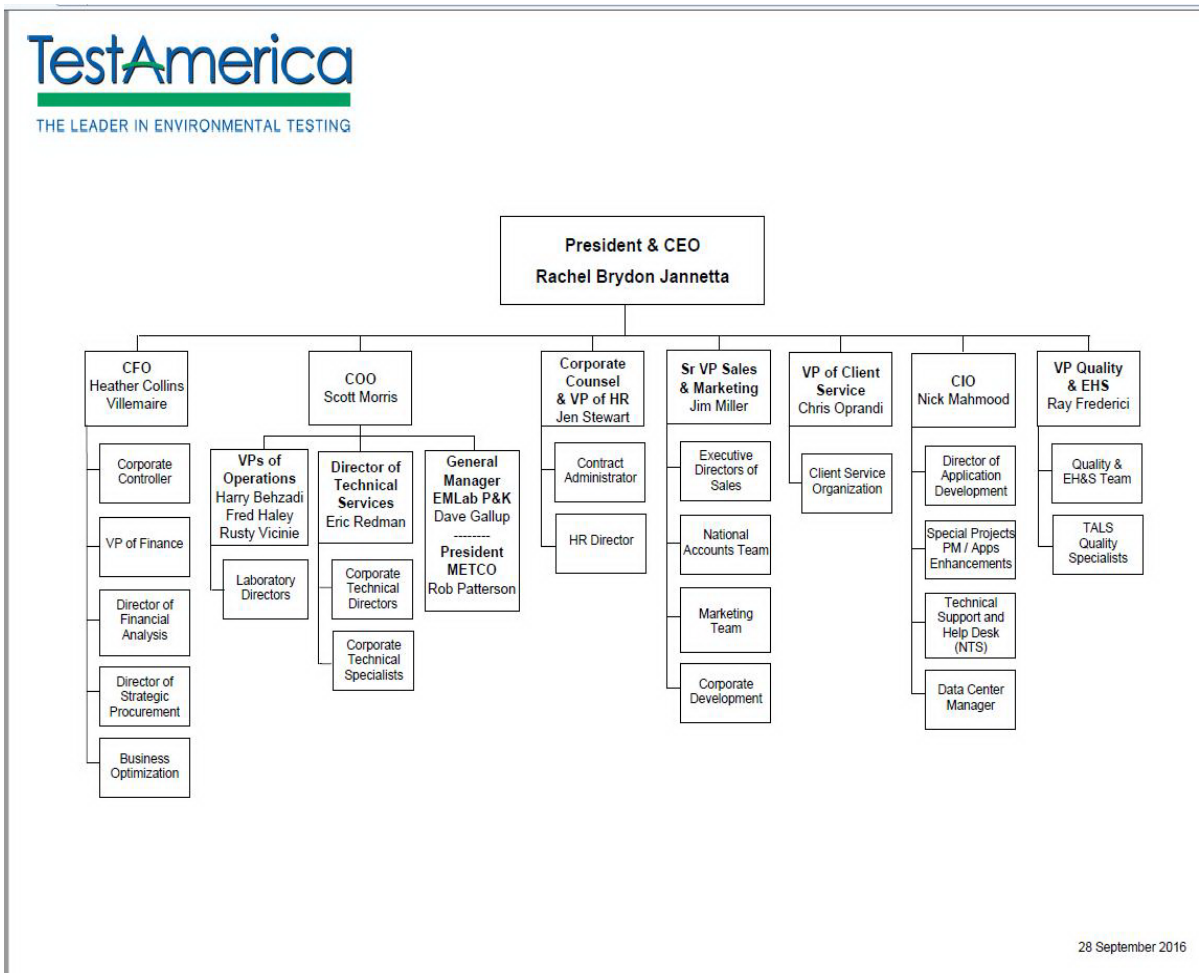
- Suggest method improvements to their supervisor, the Technical Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, 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.

4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director	Operations Manager (1) Technical Manager (2)	
QA Manager	QA Specialist (1) Operations Manager (2)	
Technical Manager	Laboratory Director (1) Operations Manager (2)	
Operations Manager	Department Manager (1) Department Manager (2)	Selected based on availability
Manager of Project Management	Project Manager (1) Client Services Director (2)	Selected based on availability
Project Manager	Project Manager (1) Project Management Asst. (2)	(1) 2° team PM (2) Team PMA
Organic Department Manager	Analyst (1) Analyst (2)	Selected based on department, experience and availability
Inorganic Department Manager	Analyst (1) Analyst (2)	Selected based on department, experience and availability
Data Validation / Data Packaging Manager	Data Validation Specialist Data Packaging Specialist	Selected based on department and availability
EHS Coordinator	Laboratory Director (1) EHS Manager (2)	
Sample Management Manager	Sample Custodian (1) EHS Coordinator (2)	
Bottle Preparation / Shipping Manager	Bottle Prep Technician (1) Sample Mng't Manager (2)	

Figure 4-1.
Corporate and Laboratory Organization Charts



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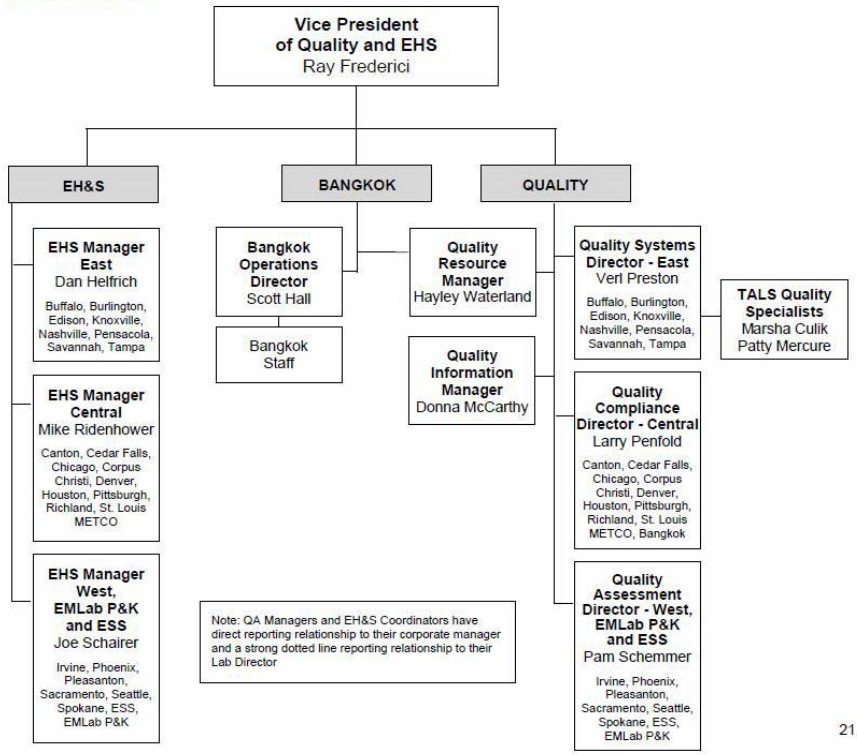
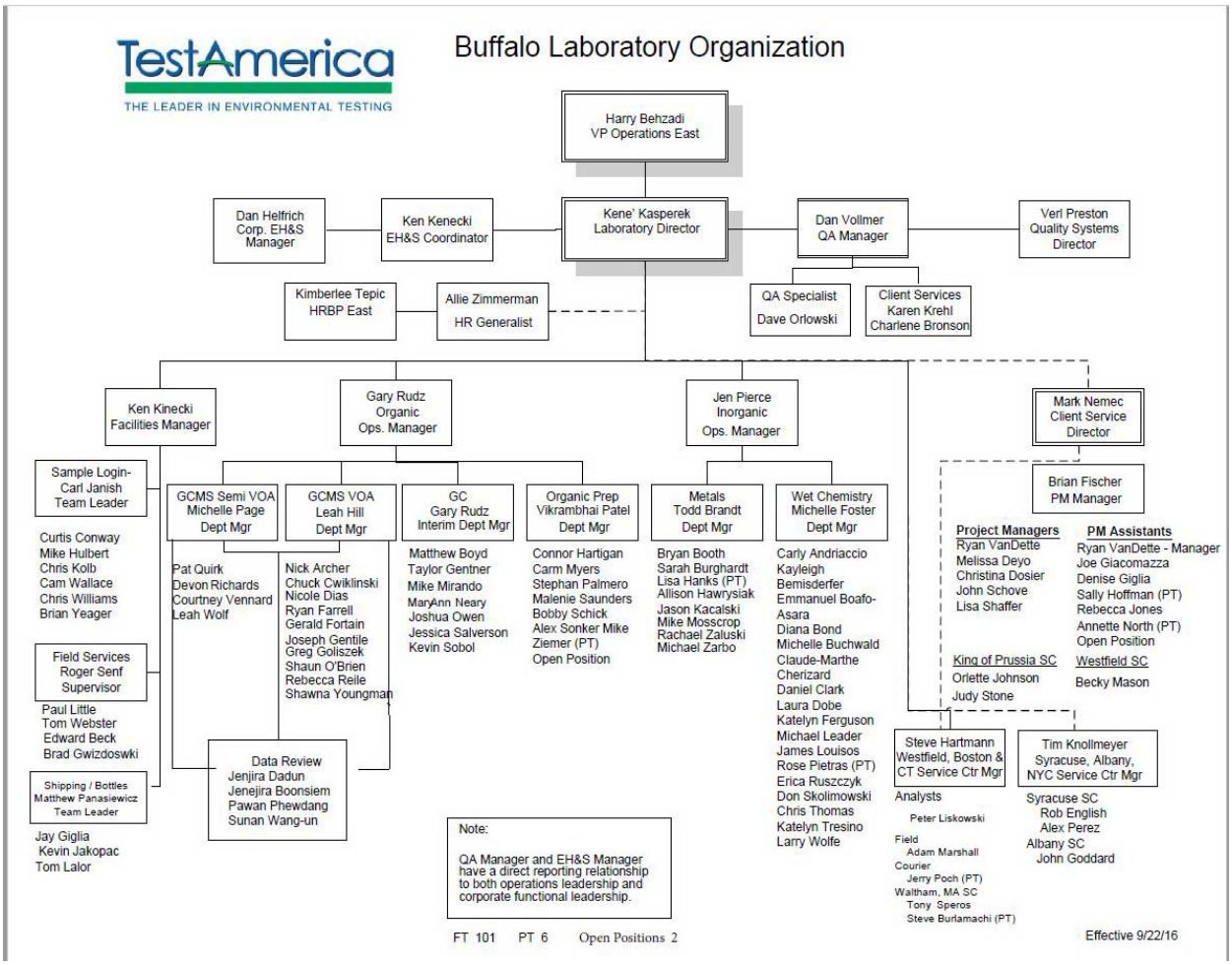
Quality, EHS, Bangkok





Note: Organizational Charts are current at the date of publication of this manual. Updated charts may be obtained by contacting the TestAmerica Buffalo Quality Department.

SECTION 5

QUALITY SYSTEM

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.
- To comply with the NELAC Standards (2003), ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

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 7 elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- 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. CW-L-S-002)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-Q-S-005).

- 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 laboratories 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
- Laboratory QA/QC 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 Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

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Note: The laboratory 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..

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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 Quality Control Limit Data in their LIMS system. A summary report is generated from LIMS to check the precision and accuracy acceptability limits for performed analyses on request. The summary report is generated and is managed by the laboratory's QA department. 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 are 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 procedure for determining the statistical limits may be found in SOP BF-QA-002, Quality Control Limits. The analysts are instructed to use the current limits in the laboratory (dated and approved the 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 through date sensitive tables within the LIMs System. 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

The QA Manager periodically evaluates these to determine if adjustments need to be made or for corrective actions to methods (SOP No. BF-QA-002). All findings are documented and kept on file.

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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.

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SECTION 6

DOCUMENT CONTROL

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. BF-QA-003.

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 notices. 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, pagination, the total number of pages of the item, or an 'end of document' page, the effective date, revision number and the laboratory's name. The Quality personnel are responsible for the maintenance of the system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a Department 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 retain that document as the official document on file. That document is then provided to all applicable operational units. 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 for the majority of procedures. Exceptions include review every 1 year for Drinking Water programs and the Kentucky CWA program. 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 No. BF-QA-003, “Writing, Reviewing and Revising Controlled Documents”. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. A controlled electronic copy of the current version is maintained on the laboratory Intranet site and is available to all personnel.

For changes to SOPs, refer to SOP No. BF-QA-003, “Writing, Reviewing and Revising Controlled Documents”.

Forms, worksheets, work instructions and information are organized by department and are maintained electronically by QA. There is a table of contents. As revisions are required, a new version number and revision date is assigned. Controlled electronic copies are made available on a public server for laboratory staff to access.

6.4 OBSOLETE DOCUMENTS

When revisions are implemented for an SOP, form or work instruction, the previous document becomes obsolete and is archived. 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 destroyed. At least one copy of the obsolete document is archived according to SOPs No. BF-GP-015 and BF-QA-003. All archived SOPs, manuals, forms or work instructions are considered obsolete.

SECTION 7

SERVICE TO THE CLIENT

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 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 laboratory'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 Client Relations Manager or Proposal Team, 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):

- Contact Administrator
- VP of Operations
- Laboratory Project Manager
- Laboratory and/or Corporate Technical Managers
- 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 reviews the formal laboratory quote and makes final acceptance for their facility.

The Sales Director, Contract Administrator, Account Executive or Proposal Coordinator 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 Contracts Department maintains copies of all signed contracts. The Project Managers at the TestAmerica Buffalo facility also maintains copies of these documents.

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.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Account Executive. A copy of the contract and formal quote will be filed with the laboratory PM and the Laboratory Director.

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 of conversations with the client.

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 a PM is assigned to each client. The PM is the first point of contact for the 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. Specific information related to project planning may be found in SOP BF-PM-001, Project Information 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 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 management 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 production 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.

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).

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 Managers/Designees 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.

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SECTION 8

SUBCONTRACTING OF TESTS

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 (CW-L-S-004) 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 TNI/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-TNI accredited work where required.

Project Managers (PMs), Client Service Managers (CSM), or Account Executives (AE) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting 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. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies, such as the Department of Energy and the USDA, may require notification prior to placing such work**.**

Approval may be documented through reference in a quote / contract or e-mail correspondence.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM, Account Executive (AE) or Client 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 is available on the TestAmerica intranet site. Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable (e.g. on the subcontractors TNI, 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;
- TNI 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. The Laboratory Director requests that the QA Manager/Designee begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures.

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 the Corporate Quality Information Manager (QIM) for review. Once all documents are reviewed for completeness, the Corporate QIM will forward the documents to the Purchasing Manager for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified 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 Corporate 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 (Form No. CW-F-WI-009)**.**
- 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 CSO personnel will notify all TestAmerica laboratories and 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 CSO Personnel, Laboratory 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 Corporate Counsel can tailor the document or assist with negotiations, if needed. The PM (or AE or CSM, etc.) 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 within the project records. For TestAmerica laboratories, certifications can be viewed on the company 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 TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must be available in TALS for all samples workshared within TestAmerica. Client COCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client COCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilities successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI 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 are 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 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; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. . The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

SECTION 9

PURCHASING SERVICES AND SUPPLIES

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, which may affect quality, 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 Capital Expenditure, Controlled Purchase Requests and Fixed Asset Capitalization, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-Wide 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, consumables 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 and TestAmerica Buffalo SOP on Solvent Purity, SOP BF-OP-013. Approval information for the solvents and acids tested under SOP CA-Q-S-001 is stored on the TestAmerica Sharepoint, under Solvent Approvals. A master list of all tested materials, as well as the certificates of analysis for the materials, is stored in the same location. [

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. Purchase requisitions are placed into the J.D. Edwards system by designated departmental personnel. The listing of items available in the J.D. Edwards system has been approved for use by the corporate purchasing staff. Each purchase requisition receives final approval by the laboratory Operations Manager or purchasing coordinator before the order is submitted.

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/designee to receive the shipment. It is the responsibility of the department that ordered the materials to document the date the materials were received. Once the ordered reagents or materials are received, the department that submitted the order compares the information on the label or packaging to the original order to ensure that the purchase meets quality level specified. This is documented through the addition of the received date and initials to the information present on the daily order log.

The purchasing manager/designee verifies the lot numbers of received solvents and acids against the pre-approval lists. If a received material is listed as unapproved, or is not listed, it is sequestered and returned to the vendor. Alternatively, the laboratory may test the material for the intended use, and if it is acceptable, document the approval on the approval list. Records of any testing performed locally are maintained on the shared “public” folder on the computer network.

Materials may not be released for use in the laboratory until they have been inspected, verified as suitable for use, and the inspection/verification has been documented.

Safety Data Sheets (SDSs) 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

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, analytical reagent grade will 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 and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOP expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date cannot not be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical/solvent must be discarded.

- Expiration dates can be extended if the dry chemical/solvent 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/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical/solvent is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained along with the calibration raw data for which the reagent was used.

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. To prevent a tank from going to dryness or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. 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- umho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25^{o}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 bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is 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 the LIMS system, 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 Manager 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 Technical Manager and/or 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, is 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, Operations Manager and/or Technical Manager.

Analytical balances are serviced and calibrated annually in accordance with SOP BF-GP-002,. The calibration and maintenance services are performed on-site, and the balances are returned to use immediately following successful calibration. When the calibration certificates are received (usually within two weeks of the service), they are reviewed, and documentation of the

review is filed with the certificates. If the calibration was unsuccessful, the balance is immediately removed from service and segregated pending either further maintenance or disposal.

Calibration services for support equipment such as NIST thermometers, weight sets, etc, are obtained from vendors with current and valid ISO 17025 accreditation for calibration of the specific piece of equipment. Prior to utilizing the vendor's services, the vendor's accreditation status is verified. Once the equipment has been calibrated, the calibration certificates are reviewed by the QA department, and documentation of the review is filed with the calibration certificates. The equipment is then returned to service within the laboratory

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 Procurements & 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 (available on the intranet site).

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 Technical Manager are consulted with vendor and product selection that have an impact on quality.

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SECTION 10

COMPLAINTS

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 with 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 in the laboratory SOP related Corrective Action (BF-QA-005).

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to BF-QA-005.

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 likely hood 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 13. In addition, Corporate Management, Sales and Marketing and Information Technology (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 Quality 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)

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SECTION 11

CONTROL OF NON-CONFORMING WORK

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory standard procedures, 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 department manager for resolution. The department manager may elect to discuss it with the Technical Manager, QA Manager 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 laboratory's non-conformance and 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, Technical Manager, Operations Manager or 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 the analytical method requirements and the reason.

11.2 RESPONSIBILITIES AND AUTHORITIES

Under certain circumstances the Laboratory Director, the Technical Manager, the Operations Manager or a member of the QA team may exceptionally 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 non-conformance and corrective action procedures described in Section 12. This information may also need to 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 laboratory management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, Technical Manager, and QA Manager. Suspected misrepresentation issues may also be reported to any member of the corporate staff as identified in Ethics Policy, CW-L-P-004. The data integrity hotline (1-800-736-9407) may also be used. 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), (e.g., the VP-QA/EHS)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, QA Manager, ECOs, Corporate Quality, Executive VP of Operations 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.

Corporate SOP entitled Data Recalls (CW-Q-S-005) is the procedure to be followed when it is discovered that erroneous or biased data may have been reported to clients or regulatory agencies.

Corporate SOP entitled Internal Investigations (CW-L-S-002) is the procedure to be followed for investigation and correction of situations involved alleged incidents of misconduct or violation of the company's ethics policy.

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. CW-Q-S-005.

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. Periodically as defined by the laboratory's preventive action schedule, 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 VP of Operations 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 (i.e., 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 Manager, Operations Manager, QA Manager, Department Manager) 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.

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SECTION 12

CORRECTIVE ACTION

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 (NCM) and Corrective Action Reports (CAR) (refer to Figure 12-1).

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 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
- Project Management concerns regarding specific analytical results
- Discrepancies in materials / goods received vs. manufacturer packing slips.

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
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

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. A 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 Department Manager, Operations Manager, Technical 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 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness. Corporate SOP Root Cause Analysis (No. CA-Q-S-009) describes the procedure.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Department Manager, Operations Manager 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 and the Operations Manager are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCM is entered into the Laboratory Information Management System (LIMS) and each CAR is entered into the Incident and Corrective Action Tracker (iCAT) database for tracking and trending purposes for review to aid in ensuring that the corrective actions have taken effect.
- TestAmerica laboratories began using the Incident/Corrective Action Tracker (iCAT) database developed by the company in 2015. (Previously, a local spreadsheet database served this purpose.) An incident is an event triggering the need for one or more corrective actions as distinct from a corrective action, a potential deficiency stemming from an incident that requires investigation and possibly fixing. The database is independent of TALS, available to all local and corporate managers, and capable of notifying and tracking multiple corrective actions per event, dates, and personnel. iCAT allows associated document upload, categorization (such as, external/internal audit, client service concerns, data quality issues, proficiency testing, etc.), and trend analysis. Refer to Figure 12-1.

- 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.

12.3.5 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 15.1.4, 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 a 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 maintain 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.

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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.

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Figure 12-1.
Example – iCAT Corrective Action Notice

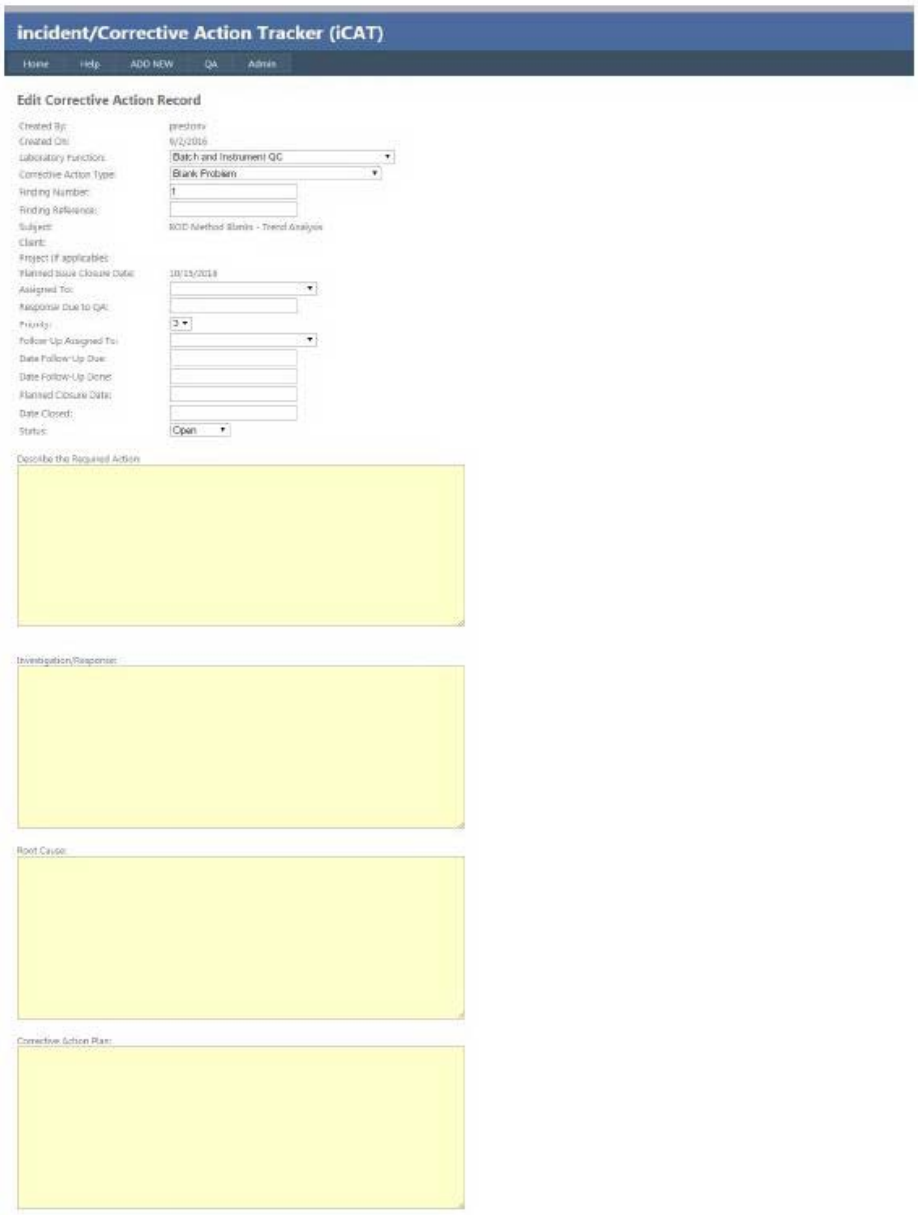

Table 12-1.

Example – General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc.
Initial Calibration Standards *(Analyst, Department Manager)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Department Manager)*	- % 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 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 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. -For matrix spike or duplicate results outside criteria the data for the data for that sample shall be reported with qualifiers.

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QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMs.	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) When the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **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 or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
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. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Department Manager)*	- 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.

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QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Internal / External Audits *(QA Manager, Department Manager, Operations Manager, Technical Manager, Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc.	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting / Calculation Errors *(Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager, QA Manager, Corporate QA, Corporate Management)*	- SOP CW-Q-S-005, Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-Q-S-005 or lab SOP BF-QA-005
Client Complaints *(Project Managers, Lab Director, Sales and Marketing, QA Manager)*	-	- 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, Operations Manager Department 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.
Health and Safety Violation *(EH&S Coordinator, Lab Director, Operations Manager, Department Manager)*	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through EH&S office.

Note: 1. Except as noted below for certain compounds, the method blank should be below the reporting 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 provided they appear in similar levels in the reagent blank and samples. This allowance presumes that the reporting limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and the other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

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SECTION 13.0

PREVENTIVE ACTION / IMPROVEMENT

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 and continuous process of improvement activities 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, the laboratory continually strives to improve customer service and client satisfaction through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered through any of the following:

- review of the monthly QA Metrics Report,
- trending NCMs,
- review of control charts and QC results,
- trending proficiency testing (PT) results,
- performance of management system reviews,
- trending client complaints,
- review of processing operations, or
- staff observations.

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and 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. The metrics report is reviewed monthly be the laboratory management, Corporate QA and TestAmerica's Executive Committee. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

Items identified as continuous improvement opportunities to the management system may be issued as goals from the annual management systems review, recommendations from internal audits, white papers, Lesson Learned, Technical Services audit report, Technical Best Practices, or as Corporate or management initiatives.

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 and non-conformances provides a valuable mechanism for identifying preventive action opportunities.

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13.1.1 The following elements are part of a preventive action system/process improvement system:

- Identification of an opportunity for preventive action or process improvement.
- Process for the preventive action or improvement.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action or improvment.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action or improvement.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action or Process Improvement. Documentation of Preventive Action/Process Improvement is incorporated into the monthly QA reports, corrective action process and management review

13.1.2 Any Preventive Actions/Process Improvements undertaken or attempted shall be taken into account during the Annual Management Systems Review (Section 17). A highly detailed report is not required; however a summary of success and failure within the preventive action program is sufficient to provide management with a measurement 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 procedures, 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 changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division's Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes.

SECTION 14.0

CONTROL OF RECORDS

The laboratory maintains a records management 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. Exceptions for programs with longer retention requirements are discussed in Section 14.1.2. TestAmerica Buffalo SOP BF-GP-015, Record Storage and Retention, specifies additional storage, archiving and retention procedures.

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 past of the regular laboratory backup. 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). Hardcopy technical records are maintained by the Laboratory Director and the QA Department while electronic technical records are maintained by the IT Administrator.

Table 14-1. Record Index[1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - Policy Memorandums - SOPs - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - 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)

	Record Types [1]:	Retention Time:
Project Records	- Sample Receipt & COC Documents - Contracts and Amendments - Correspondence - QAPP -SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	All HR docs have different retention times: Refer to HR Manual
	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 according to BF-GP-015 and in such a way that they are secure and readily retrievable at the laboratory facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. Records are maintained for a minimum of five years unless other wise specified by a client or regulatory requirement. 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 and shall be documented with an access log.

If records are archived off-site they are to be stored in a secure location where a record is maintained of any entry into the storage facility.

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. Specific Information related to archival of data for greater than 5 years may be found in TestAmerica Buffalo SOP BF-GP-015.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	5 years (project records) 10 years-Radiochemistry (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Alaska	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Navy Facilities Engineering Service Center (NFESC)	5 years
NY Potable Water NYCRR Part 55-2	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements are noted with the archive documents or addressed in TestAmerica Buffalo facility-specific records retention procedure BF-GP-015.

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. TestAmerica Buffalo SOP BF-GP-015 also contains specific information for archival of scanned data.

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 (any records stored off site should be accessible within 2 business 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 chain of custody is stored with the project file and the Job Number in TALS. 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. Calibration data for a given sequence are maintained in the order of the analysis. Sample data are stored on a job number basis in the project file or as part of the daily batch or sequence. Run logs are maintained for each instrument or method; a copy of each day's run log 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, bench sheets or excel spreadsheets are used to record and file data. Standard and reagent information is recorded in logbooks or on the raw data for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. 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 TestAmerica SOP BF-GP-015.

- Also refer to Section 19.14.1 '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 sampling, performance of each analysis and reviewing of results.

14.2.2 Observations, data and calculations are recorded real-time.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. 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 bench sheet.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in the method specific SOPs, in the instrument method detail records or the instrument maintenance logs 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, ID codes, volumes, weights, instrument printouts, meter readings, temperatures, 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.
- 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 (also known 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 instrument or analysis basis, and are numbered sequentially as they are issued. No instrument or analysis has more than one active notebook at a time, so all data are recorded sequentially within a series of sequential notebooks. Bench sheets and raw data sequence files are filed sequentially by date. Standard and reagent information is maintained in LIMS and logbooks which are maintained on a departmental basis and are numbered sequentially as they are issued or as they are archived by QA.

14.5.5 Records are considered archived when noted as such in the records management system (also known as document control). Access to archived hard-copy information is documented with an access log and in/out records is used to note data that is removed and returned.

14.5.6 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.

14.5.7 Records Disposal

14.5.7.1 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).

14.5.7.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records Management Company is hired to dispose of records, a "Certificate of Destruction" is required**.**

SECTION 15

AUDITS

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 Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. 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 Audits	QA Department, QA approved designee or Corporate QA	All areas of the laboratory annually
Method Audits QA Technical Data Audits SOP Compliance Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	QA Methods Audits Frequency: All methods are reviewed annually 50% of methods receive a QA Technical Audit 50% of methods receive a SOP Method Compliance Audit
Special	QA Department or Designee	Surveillance or spot checks performed as needed to monitor specific issues
Performance Testing	Coordinated by Corporate QA	Two successful per year for each TNI -NELAP 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, TestAmerica's Data Integrity and Ethics Policies, TNI 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 for effectiveness & sustainability. The

audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed 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 assess data authenticity and analyst integrity. These 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, Chrom AuditMiner is used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period. All analysts should be reviewed over the course of a two year period through at least one QA Technical Audit

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 Manager or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst 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, Non-potable Water, Soil, and Air.

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. When requested, 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 2009 TNI 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. . When requested, 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.

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SECTION 16

MANAGEMENT REVIEWS

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 Managers, their Quality Director as well as the VP of Operations. 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 Director prepares 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 VPs of Operations.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Manager, Operations Manager, and 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 goals, objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel may 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 systems review (Corporate SOP No. CW-Q-S-004 & Work Instruction No. CW-Q-WI-003) 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.

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- 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 VP of Operations 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.

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. The TestAmerica Corporate Internal InvestigationsSOP shall be followed (SOP No. CW-L-S-002). 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 President and CEO, COO, Technical & Operations Support, VP of Client and Technical Services, VPs of Operations and Quality Directors receive a monthly report from the VP QA/EHS summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL

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 staff that possesses 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 in 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, pipette, 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 Managers/Department Managers – **General**	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

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 – 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 20).
- 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.
- The Human Resource office maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics violations). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in TestAmerica Buffalo SOP BF-QA-004, Laboratory Personnel Training.

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 followed by technical data integrity training within 30 days, 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 No. CW-L-P-004 and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics 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

18.1 OVERVIEW

TestAmerica Buffalo is a 32,000 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 field operations, bottle kit preparation, 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 affect 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. Key equipment has been provided with back-up power supply in the event of a power outage.

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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.

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 pass cards and alarm codes are distributed to all facility employees.

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. [The reason for this is that it is important to know who is in the building in case of a safety emergency. The visitors logbook is used to ensure that everyone got out of the building safely.] 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.

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SECTION 19.0

TEST METHODS AND METHOD VALIDATION

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 CW-Q-S-002, Writing a Standard Operating Procedure (SOP) and Laboratory SOP BF-QA-003, Procedure for Writing, Reviewing and Revising Controlled Quality Documents (QAM, SOP, etc)
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water 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.

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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, etc.), 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.

19.4.1.1 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:

- *Method 1664, Revision A: N-Hexane Extractable Material (HEM; Oil and Grease) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM); Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999*
- *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, US EPA, January 1996.*
- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act; Analysis and Sampling Procedures; 40CFR Part 136 as amended by Method Update Rule; May 18, 2012*
- *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 & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th / 21st/ 22nd/on-line 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; Final Update IV, January 2008; Final Update V, August 2015.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)* ***(DW labs only)***
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *New York State DEC Analytical Services Protocol, 2005*
- *New York State DOH Methods Manual*
- *Massachusetts Contingency Plan 310 CMR 40, April 25, 2014*
- *Connecticut Reasonable Confidence Protocol, July 2006*

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 (BF-QA-004) is performed whenever there is a significant change in instrument type (e.g., new instrumentation), method or personnel.

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Operations Manager/Designee 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 a method detection limit 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).

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- 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

Procedures for generation of IDOCs are detailed below and in laboratory SOP BF-QA-004, Laboratory Personnel Training.

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 (see Figure 19-1) 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.

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 can be differentiated from blanks. 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. BF-QA-001 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. (For CLP procedures, the IDL is determined using the standard deviation of 7 replicate spike analyses on each of 3 non-consecutive days.)

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 no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, CVAA, etc.) and no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified or see section 20.7.9 for other options. 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 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 requirement.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis 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's 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, 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 uncertainties at approximately the 99% confidence level with a coverage factor of k = 3. As an example, for a reported result of 1.0 mg/L with an LCS recovery range of 50 to 150%, the estimated uncertainty in the result would be 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 re-preparation (where appropriate) and subsequent analysis (hereafter referred to as "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 supersede 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 Department 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. The laboratory is currently running the 'TALS Data System' which is a 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 a 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, and 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. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

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, 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 such as password protection or website access approval, 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 data review sheets, 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 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 project job folder, computer file, and/or run log. 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, final inorganic results are reported to 2 significant figures for values less than 10 and 3 significant figures for values greater than 10 on the final report. Organic results are generally reported to 1 significant figure for values less than 10 and 2 significant figures for values greater than 10 on the final report. The number of significant figures may be adjusted based on client or project requirements.

19.14.2.4 For those methods that do not have an instrument printout, an instrumental output or a calculation spreadsheet upload compatible with the LIMS System, the final results and dilution factors are entered directly into LIMS by the analyst, and the software formats 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 automatically transferred to the network server and, eventually, to a back-up 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.)

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- 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 Technical Manager/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 laboratory SOPs (e.g. BF-SR-002, "Receipt of Analytical Samples", BF-GP-012, "Technical Data Review", and BF-PM-001, "Project Information Requirements") 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 an SOP discussing Manual Integrations to ensure the authenticity of the data (BF-GP-013, Manual Integration). The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 Log-In Review - The data review process starts at the sample receipt stage. Sample control personnel review chain-of-custody forms and project instructions from the project management group. This is the basis of the sample information and analytical instructions entered into the LIMS. The log-in instructions are reviewed by the personnel entering the information, and a second level review is conducted by the project management staff.

19.14.4.2 First Level Data Review –The next level of data review occurs with the analysts. As data are generated, analysts review their work to ensure that the results meet project and SOP requirements. First level reviews include inspection of all raw data (e.g., instrument output for continuous analyzers, chromatograms, spectra, and manual integrations), evaluation of calibration/calibration verification data in the day's analytical run, evaluation of QC data, and reliability of sample results. The analyst transfers data into LIMS, data qualifiers are added as needed. All first level reviews are documented.

19.14.4.3 Second Level Data Review – All analytical data are subject to review by a second qualified analyst or supervisor. Second level reviews include inspection of all raw data (e.g., instrument output, chromatograms, and spectra) including 100% of data associated with any changes made by the primary analyst, such as manual integrations or reassignment of peaks to different analytes, or elimination of false negative analytes. The second review also includes evaluation of initial calibration/calibration verification data in the day's analytical run, evaluation of QC data, reliability of sample results, qualifiers and NCM narratives. Manual calculations are checked in second level review. All second level reviews are documented.

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

19.14.4.4 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Director/Manager, Technical Manager, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.4.5 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.4.6 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 COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met. The Project Manager may also evaluate the validity of results for different test methods given expected chemical relationships.

19.14.4.7 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 and creates the invoice. When complete, the report is issued to the client.

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 SOP CA-Q-S-002 as the guidelines.

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 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 principles 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.

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Figure 19-1.
Example - Demonstration of Capability Documentation

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

BF-QA-DOC-004
DOC Cert. Statement
Rev. 3 9/28/2016

TESTAMERICA LABORATORIES, INC.

DEMONSTRATION OF CAPABILITY CERTIFICATION STATEMENT

Employee Name (print): _____

Method Number: _____ Matrix (circle): water / soil / air

Parameters or Analytes: _____

Date Submitted: _____

Initial Demonstration of Capability:

SOP Number: _____Revision # _____ Date Read_____

Trained By (print name): _____

Date training began: _____

Date training completed: _____

Continued Demonstration of Capability:

SOP Number: _____Revision # _____ Date Read_____

Demonstration of Capability Reviewed and Analyst Authorized to Perform Method:

_____ _____ _____
Department Manager/Designee Signature Date

_____ _____ _____
QA Manager/Designee Signature Date

SECTION 20

EQUIPMENT (AND CALIBRATIONS)

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 equipment and instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's 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 lubrication, 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 also be 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 instrumentation records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

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.

At a minimum, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) 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, field sampling devices, 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. Laboratory SOPs BF-GP-001,"Calibration of Autopipettes and Repipetters" and BF-GP-002, "Support Equipment: Maintenance, Record Keeping and Corrective Actions of Analytical Balances, Temperature Control Devises and Reagent Water" provide additional detail on the monitoring and record keeping for support equipment.

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.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 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 reusable thermometers are calibrated on an annual basis with a NIST-traceable thermometer.

- If the temperature measuring device is used over a range of 10°C or less, then a single point verification within the range of use is acceptable;
- If the temperature measuring device is used over a range of greater than 10°C, then the verification must bracket the range of use.

Disposable thermometers are discarded upon expiration and replaced with newly purchased thermometers. IR thermometers should be calibrated over the full range of use, including ambient, iced (4 degrees) and frozen (0 to -5 degrees), per the Drinking Water Manual. The IR thermometers are verified daily and calibrated quarterly. Digital probes and thermocouples are calibrated quarterly.

The NIST Mercury 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 digital

thermometer is recalibrated every one year (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 laboratory SOP BF-GP-020, "Thermometer Calibration".

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 > 0ºC and ≤ 6 ºC.

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 and Glass microliter syringes) are given unique identification numbers and the delivery volumes are verified gravimetrically at a minimum on a quarterly basis.

For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements.

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.

20.3.6 Field Sampling Devices (Isco Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

The Auto Sampler is calibrated monthly (or if not utilized monthly, immediately prior to its usage) by setting the sample volume to 100ml and recording the volume received. The results are filed in a logbook/binder. The Auto Sampler is programmed to run three (3) cycles and each of the three cycles is measured into a graduated cylinder to verify 100ml are received.

If the RSD (Relative Standard Deviation) between the 3 cycles is greater than 10%, the procedure is repeated and if the result is still greater than 10%, then the Auto Sampler is taken out of service until it is repaired and calibration verification criteria can be met. The results of this check are kept in a logbook/binder.

Additional calibration and use information is detailed in laboratory SOP BF-FS-006, “Calibration of Field Meter”.

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

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points will be used.

20.4.1.1 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.

20.4.1.2 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).

20.4.1.3 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exceptions to these rules is ICP and ICPMS methods which define the working range with periodic linear dynamic range studies, rather than through the range of concentrations of daily calibration standards.

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). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source. 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 2009 TNI Std. EL-V1M4, section 1.7.1. 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. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

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 i.e., RPD, per NELAC (2003) Standard, Section 5.5.5.10 and 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

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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 then bracketing calibration verification 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).

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements see specific SOPs. Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

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).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions:

a).when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b).when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.2.1 Verification of Linear and Non-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.

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.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

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).

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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. See laboratory SOP's BF-MB-005 and BF-MV-007 for guidelines for making tentative identifications

Note:
For general reporting if TICs are requested, the ten (10), largest non-target analyte peaks whose area count exceeds 10% of the nearest internal standard will be termed "Tentatively Identified Compounds" (TICs). More or fewer TICs may be identified based on client requirements.

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.

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Table 20-1. Laboratory Equipment and Instrumentation – TestAmerica Buffalo

TestAmerica Buffalo
Equipment/Instrument List

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Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
GC/MS Instrumentation	Agilent	5975	US83110163	2013	good
GC/MS Instrumentation	Agilent	5973	US05605976	2001	good
GC/MS Instrumentation	Agilent	5973	US44621446	2005	good
GC/MS Instrumentation	Agilent	5973	US52420646	2005	good
GC/MS Instrumentation	Agilent	5973	US05060084	2001	good
GC/MS Instrumentation	Agilent	5973	US03950346	2001	good
GC/MS Instrumentation	Agilent	5973	US82321636	2001	good
GC/MS Instrumentation	Agilent	5973	US21854062	2003	good
GC/MS Instrumentation	Agilent	5973	US41720721	2009	good
GC/MS Instrumentation	Agilent	5973	US30965692	2003	good
GC/MS Instrumentation	Agilent	5973	US30965634	2003	good
GC/MS Instrumentation	Agilent	5973	US35120354	2004	good
GC/MS Instrumentation	Agilent	5973	US41720707	2004	good
GC/MS Instrumentation	Agilent	5975	US80838844	2001	good
GC/MS Instrumentation	Agilent	5975	US83130241	2013	good
GC/MS Instrumentation	Agilent	5973	US02450141	2012	good
GC Instrumentation	Agilent	6890 dual uECD	CN10520009	2005	good
GC Instrumentation	Agilent	6890 dual uECD	CN10520010	2005	good
GC Instrumentation	Agilent	6890 dual uECD	CN10448015	2005	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3310A47661	1993	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53325	1993	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53464	1994	good
GC Instrumentation	Hewlett Packard	5890II dual ECD	3336A53463	1994	good
GC Instrumentation	Hewlett Packard	5890II dual FID	3336A53727	1994	good
GC Instrumentation	Hewlett Packard	5890II dual FID	3019A28433	1991	good
GC Instrumentation	Hewlett Packard	5890II FID/FID	3336A53729	1994	good
GC Instrumentation	Hewlett Packard	5890II Hall/PID	3121A35782	1990	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3336A60622	1994	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3133A37157	1993	good
GC Instrumentation	Hewlett Packard	5890II PID/FID	3336a53465	1994	good
GC Instrumentation	Agilent	6890N dual uECD	CN10839003	2005	good
GC Instrumentation	Agilent	7890N dual FID	CN10833020	2005	good
GC Instrumentation	Perkin Elmer	Clarus 600 dual FID	665S10020401	2012	good
GC Instrumentation	Perkin Elmer	Clarus 600 dual FID	680s10101807	2013	good
GC Instrumentation	Perkin Elmer	Clarus 608 dual uECD	680S10042901	2012	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	99110569	1999	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	02060196	2002	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	20126	2004	good
Ion Chromatography Instrumentation	Dionex	Ion Chromatograph #DX-120	98050413	1999	good
Metals Instrumentation	Environmental Express	AutoBlock Plus	AB4001-1213-042	2013	Good

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TestAmerica Buffalo
Equipment/Instrument List

Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
Metals Instrumentation	Leeman	PS200 II	HG0033	2000	good
Metals Instrumentation	Leeman	PS200 II	4026	2000	good
Metals Instrumentation	Perkin Elmer	Elan 9000 ICP-MS	P0230202	2002	good
Metals Instrumentation	Thermo	ICAP 6000 Duo	ICP-20094603	2010	good
Metals Instrumentation	Thermo	ICAP 6000 Duo	ICP-20094602	2010	good
Sample Preparation Equipment	CEM	Microwave MARS	MD3978	2013	good
Sample Preparation Equipment	Gilson	Fractionator Model GX-274	40579	2013	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G1647/C5659	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2665/C5674	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2620/C5660	1994	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2245/C6328	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2621/C6733	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2713/C6732	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G1643/C6837	1995	good
Sample Preparation Equipment	Heat Systems	Sonicator #XL-2020	G2742/C6842	1995	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16902	1999	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16907	1999	good
Sample Preparation Equipment	Organomation	Rot-X-Tractor	16913	1999	good
Sample Preparation Equipment	TurboVap	II	TV0529N12427	2006	good
Sample Preparation Equipment	TurboVap	II	TV0529N12428	2006	good
Sample Preparation Equipment	TurboVap	II	TV9445N5816	1996	good
Sample Preparation Equipment	TurboVap	II	TV9427N4133	1996	good
Sample Preparation Equipment	TurboVap	II	TV944N5819	1996	good
Sample Preparation Equipment	TurboVap	II	TV944N5820	1996	good
Sample Preparation Equipment	TurboVap	II	TV0024N9623	2000	good

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TestAmerica Buffalo
Equipment/Instrument List

Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
Sample Preparation Equipment	TurboVap	II	TV0022N9604	2000	good
Sample Preparation Equipment	TurboVap	II	TV0312N11592	2003	good
Sample Preparation Equipment	TurboVap	II	TV0312N11591	2003	good
Water Quality Instrumentation	Flash Point Analyzer	HFP 339	73390092	2007	good
Water Quality Instrumentation	Flash Point Analyzer	Optiflash 104002	Herzog PAC 000334	2015	good
Water Quality Instrumentation	Glastron	CN Midi-distillation	2502	2003	good
Water Quality Instrumentation	Glastron	Phenol Midi-distillation	2069	2003	good
Water Quality Instrumentation	Glastron	Phenol Midi-distillation	2053	2003	good
Water Quality Instrumentation	Horizon	Speed Vap	03-0415	2005	good
Water Quality Instrumentation	Konelab	20	S5019455	2004	good
Water Quality Instrumentation	Konelab	20XT	E3719731	2005	good
Water Quality Instrumentation	Konelab	Aqua20	SEA032	2009	good
Water Quality Instrumentation	Lachat	Quickchem 8000 Autoanalyzer	A83000-1527	2000	good
Water Quality Instrumentation	Lachat	Quickchem 8500 Autoanalyzer	40300001665	2014	good
Water Quality Instrumentation	Lachat	Quickchem 8500 Autoanalyzer	1106 0000 1336	2013	good
Water Quality Instrumentation	Mantech	BOD Analyzer	MT-0B4-215	2015	good
Water Quality Instrumentation	Mantech	BOD Autoanalyzer	MS-1LO-157	2014	good
Water Quality Instrumentation	ManTech	PC Titrator	MS-OK2-607	2003	good
water Quality Instrumentation	Mantech	PC Titrator	MT-1H5-971	2016	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	A547730578	2005	good
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	E616730030	2006	good

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TestAmerica Buffalo
Equipment/Instrument List

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Equipment/Instrument	Manufacturer	Model Number	S/N from instrument	Year Put into Service	Condition When Received
Water Quality Instrumentation	OI	Carbon Analyzer Model 1030	P410730479	2014	good
Water Quality Instrumentation	Thermo Scientific	Spectrophotometer 4001/4	3SGT048005	2015	good
Water Quality Instrumentation	Thermo Scientific	Spectrophotometer 4001/4	3SGP283013	2016	good

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Note: The Equipment List is current at the date of publication of this manual. An updated list may be obtained by contacting the TestAmerica Buffalo Quality Department.

Table 20-2.

Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Change dryer tube Fill reductant bottle with 10% Stannous Chloride	Daily Daily As Needed Daily
ICP & ICP/MS	Check pump tubing Check liquid argon supply Check fluid level in waste container Check re-circulator levels Clean or replace filters Check torch Check sample spray chamber for debris Clean and align nebulizer Change pump oil Change Cones Change printer cartridge Replace pump tubing	Daily Daily Daily Monthly As required Daily Monthly Monthly Monthly As required As required As required
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Annually
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Oil rollers/chains/side rails Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly

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Instrument	Procedure	Frequency
Agilent GC/MS	Pump oil-level check Pump oil changing Analyzer bake-out Analyzer cleaning Resolution adjustment COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	Monthly Annually As required As required As required As required As required As required As required As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Glass wool replacement Check system for gas leaks with SNOOP Check for loose/frayed power wires and insulation Bake injector/column Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	Daily Daily via use of known compound retention Daily As required As required W/cylinder change as required As Required As Required As Required 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
Photoionization Detector (PID)	Change O-rings Clean lamp window	As required As required
HPLC	Change guard columns Change lamps Change pump seals Replace tubing Change fuses in power supply Filter all samples and solvents Change autosampler rotor/stator	As required As required Semi-annually or as required As required As required Daily As required

Instrument	Procedure	Frequency
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
Centrifuge	Check brushes and bearings	Every 6 months or as needed

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Table 20-3.

Periodic Calibration

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Analytical Balance	Accuracy determined using "S" NIST traceable weights. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily, when used Annual	± 0.2%	Clean, check level, insure lack of drafts, and that unit is warmed up, recheck. If fails, call service.
Top Loading Balance	Accuracy determined using "S" NIST traceable. Minimum of 2 standards bracketing the weight of interest. Inspected and calibrated by A2LA accredited person annually.	Daily, when used Annual	± 0.5%	Clean. Replace.
NIST Certified Weights	Accuracy determined by accredited weights and measurement laboratory.	1 year	As per certificate.	Replace.
NIST-Traceable Thermometer-Mercury	Accuracy determined by accredited measurement laboratory.	3 years	As per certificate.	Replace.
NIST-Traceable Thermometer-Digital	Accuracy determined by accredited measurement laboratory.	1 year	As per certificate	Replace.
Thermometer	Against NIST-traceable thermometer	Yearly at appropriate temperature range for intended use	± 2.0°C	Replace
Minimum-Maximum Thermometers	Against NIST-traceable thermometer	Yearly	± 2.0°C	Replace

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
InfraRed Temperature Guns	Against NIST-traceable thermometer Accuracy determined by accredited measurement laboratory.	Daily at appropriate temperature range for intended use. Annual	± 2.0°C	Repair/replace
Dial-type Thermometers	Against NIST-traceable thermometer	Quarterly at appropriate temperature range for intended use.	± 2.0°C	Replace
Refrigerator	Temperature checked using NIST-traceable thermometer.	Daily. If out of range, check again in two hours.	0-6°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Freezer	Temperature checked using NIST-traceable thermometer	Daily. If out of range, check again in two hours.	(-10)-(-20)°C	Adjust. Repair. While waiting for repair, seal door, attach "Out of Service" sign, move items to functional unit. Notify supervisor.
Oven	Temperature checked using NIST-traceable thermometer.	When in use.	104 ± 1°C (drying) 180 ± 2°C (TDS)	Adjust. Replace.
Water Bath	Temperature checked using NIST-traceable thermometer.	When in use.	± 2°C	Adjust. Replace.
Volumetric Dispensing Devices (Eppendorf ® pipette, automatic dilutor or dispensing devices)	One delivery by weight. Using DI water or solvent of use, dispense into tared vessel. Record weight with device ID number. Calibrate using 4 replicate gravimetric measurements	Each day of use Quarterly	± 2% Calculate accuracy by dividing weight by stated volume times 100 for percent.	Adjust. Replace.

Instrument	Type of Calibration/ Number of Standards	Frequency	Acceptance Limits	Corrective Action
Glass Microliter Syringes	None	Accuracy must be initially demonstrated if syringe was not received with a certificate attesting to established accuracy.	± 1%	Not applicable.
Deionized Water	Check in-line conductivity meter on system with conductivity meter in Inorganics Department.	Daily	<1.0 µmho at 25°C	Record on log. Report discrepancies to QA Manager, Operations Manager or Technical Manager.

SECTION 21

MEASUREMENT TRACEABILITY

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 and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. For certain programs Microsyringes are verified 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 and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g. bent needle). If the Class A glassware or syringe 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), or another accreditation organization that is a signatory to a MRA (Mutual Recognition Arrangement) of one or more of the following cooperations – ILAC (International Laboratory accreditation Cooperation) or APLAC (Asia – Pacific Laboratory Accreditation Cooperation)..A certificate and scope of accreditation is kept on file at the laboratory.

The calibration report or certificate submitted to ***TestAmerica Buffalo*** contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. Opinions and interpretations of results are presented along with the basis upon which they were made and identified as such. The report may be submitted by facsimile or other electronic means as long as the requirements of the International Standard are achieved. If significant amendments are made to a calibration certificate, a supplemental certificate for the serial-number-specified piece of equipment is so identified. When a new certificate is offered, it uniquely identifies and references the one it replaces. All calibration reports are filed in the QA Office.

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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 ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- 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. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered 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. Method specific information may also be found in the laboratory method SOPs in the "Standards and Reagents" sections. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

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 SOP No. 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 by each department in bound or electronic folders. 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 laboratory SOP BF-GP-019, “Standard Traceability and Preparation” and also to the 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. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory department’s chemical history log and are assigned a unique identification number. Preparation of working standards or reagents prepared from the stock is documented in the laboratory Department’s Standard Preparation Log. The following information is typically recorded:

- 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 section

Records are maintained 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
- Standard ID from LIMS.
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained in the LIMS system.

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)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an 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 preparation/analytical batch records.

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 SOPs.

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SECTION 22.0

SAMPLING

22.1 OVERVIEW

The laboratory provides sampling services. Sampling procedures are described in the following SOPs:

BF-FS-001	Chain of Custody Documentation
BF-FS-003	Groundwater Sampling Field Data Collection
BF-FS-004	Equipment Decontamination
BF-FS-005	Groundwater/Surface Water Sampling
BF-FS-006	Calibration of Field Meter
BF-FS-007	Low Flow Sampling Procedures
BF-FS-008	Surface and Subsurface Soil/Sediment Sampling

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. Certificates of cleanliness for bottles and preservatives are provided by the supplier and are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory online.

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 chain-of-custody (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. 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. These programs will be addressed on a case-by-case basis.

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the laboratory SOPs are derived from the source documents for the methods. If method required holding times, this info is in the SOP 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.

The following information provides general guidance for homogenization and subsampling. For laboratory specific procedures refer to SOP BF-GP-005, "Sample Homogenization and Subsampling".

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SECTION 23

HANDLING OF SAMPLES

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.

When the sampling personnel deliver the samples directly to TestAmerica personnel 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. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility 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. The shipping documents are retained with the project files.

23.1.2 Legal / Evidentiary Chain-of-Custody

If samples are identified for legal/evidentiary purposes on the COC or in the project notes, sample management will initiate Strict Chain of Custody procedures as defined in SOP BF-GP-018, "Strict Internal Chain-of-Custody".

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.

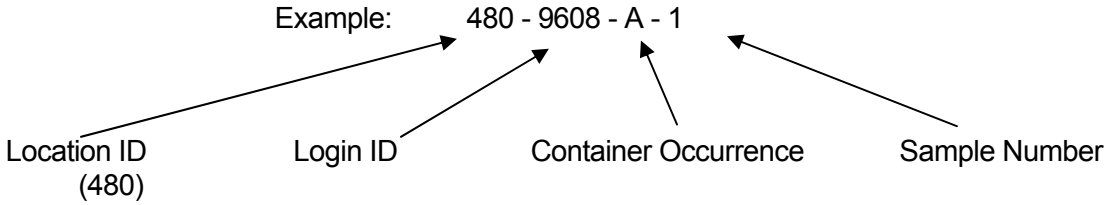
23.2.1 Laboratory Receipt

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 on the Sample Login Form – and brought to the immediate attention of 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 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):



The above example states that TestAmerica Buffalo Laboratory (Location 480). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: XXX - 9608 - A - 1 - **A** ← **Secondary Container Occurrence**

Example: 220-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 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);
- every sample cooler is given a radiation screen with a standardized Radiation Monitor (Monitor 4 model). This screen has no analytical repercussions; it is just a gross screen for employee safety purposes. Contact TestAmerica Buffalo's Technical Manager, Environmental Health and Safety Coordinator or Sample Control Manager immediately if screening indicates radioactivity in excess of 0.02 mR/hr.;
- 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.

23.3.1 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.

23.3.2 Any deviations from these checks described in Section 23.1.1.1 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 SOP No. BF-SR-002.

23.4 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, freezers or protected locations suitable for the sample matrix. Aqueous samples designated for metals analysis are stored at ambient temperature. 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 at a minimum of every two weeks.

Analysts and technicians provide a request form to the cooler custodian who then retrieves the requested samples. In the absence of the cooler custodian, the analysts may personally retrieve the sample containers allocated to their analysis from the designated refrigerator. The samples are placed on carts, transported the analytical area and analyzed. Following analysis

the remaining sample is returned to the refrigerator from which it originally came. All unused portions of samples are returned to the secure sample control area. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. After two to four weeks the samples are moved to dry room temperature, sample archive area where they are retained a minimum of 2 weeks after the final report has been issued to the client at which time disposal occurs. Special arrangements may be made to store samples for longer periods of time. Extended archival periods allow 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.

23.5 HAZARDOUS SAMPLES AND FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, samples which are known or suspected to be hazardous are segregated and a notification is issued to all laboratory personnel.
All hazardous samples are either returned to the client or disposed of appropriately through a hazardous waste disposal firm. All soil samples, including foreign soil samples are heat treated or incinerated in accordance with USDA permit requirements and are transported / disposed by USEPA approved facilities.

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.

23.6 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). For sample shipments which include water/solid volatile organic analyses (see Note), a trip blank is enclosed when required by method specifications or state or regulatory programs. 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.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will analyze the trip blanks that were supplied.

23.7 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: BF-WM-001, "Waste Management".) All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than six weeks 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 may request to 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 and nature of disposal (such as sample depletion, hazardous waste facility disposal, and return to client). All disposal of sample containers is accomplished through incineration. A Waste Disposal Record should be completed.

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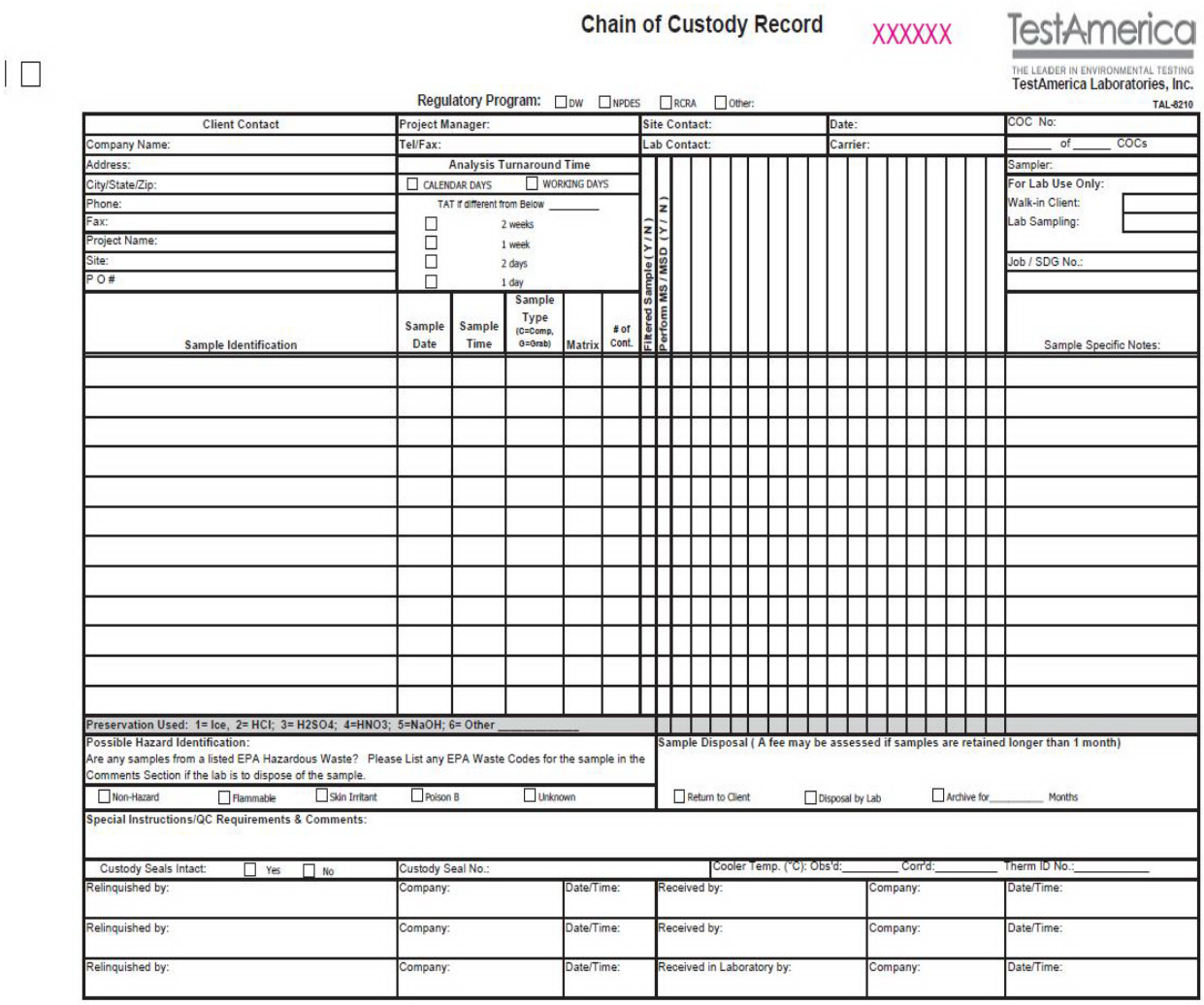
Figure 23-1.

Example: Chain of Custody (COC)



Chain of Custody Record XXXXXX

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TestAmerica Laboratories, Inc.
TAL-8210

Regulatory Program: ☐ DW ☐ NPDES ☐ RCRA ☐ Other:

Client Contact	Project Manager:	Site Contact:	Date:	COC No:
Company Name:	Tel/Fax:	Lab Contact:	Carrier:	____ of ____ COCs
Address:	Analysis Turnaround Time			Sampler:
City/State/Zip:	☐ CALENDAR DAYS ☐ WORKING DAYS			For Lab Use Only:
Phone:	TAT if different from Below ____			Walk-in Client:
Fax:	☐ 2 weeks			Lab Sampling:
Project Name:	☐ 1 week			
Site:	☐ 2 days			Job / SDG No.:
P O #	☐ 1 day			

Sample Identification	Sample Date	Sample Time	Sample Type (C=Comp, G=Grab)	Matrix	# of Cont.	Filtered Sample (Y / N)	Perform MS / MSD (Y / N)	Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification:
Are any samples from a listed EPA Hazardous Waste? Please List any EPA Waste Codes for the sample in the Comments Section if the lab is to dispose of the sample.
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ Return to Client ☐ Disposal by Lab ☐ Archive for_____ Months

Special Instructions/QC Requirements & Comments:

Custody Seals Intact: ☐ Yes ☐ No | Custody Seal No.: | Cooler Temp. (°C): Obs'd:_____ Corr'd:_____ Therm ID No.:_____

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received in Laboratory by:	Company:	Date/Time:

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) Every sample cooler is given a radiation screen with a standardized Radiation Monitor (Monitor 4 model). This screen has no analytical repercussions; it is just a gross screen for employee safety purposes. Contact TestAmerica Buffalo's Technical Manager, Environmental Health and Safety Coordinator or Sample Control Manager immediately if screening indicates radioactivity in excess of 0.02 mR/hr.

3) Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or

courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

4) 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**

5) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested.

6) Samples must be preserved according to the requirements of the requested analytical method. See lab Sampling Guide.
   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 prior to analysis and documented, either in sample control or at the analyst's level. The project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

   - For Volatile Organic analyses in drinking water (Method 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:
     - 1. Test for residual chlorine in the field prior to sampling.
       - If no chlorine is present, the samples are to be preserved using HCl as usual.
       - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.
     - 2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.
   - **FOR WATER SAMPLES TESTED FOR CYANIDE – for NPDES samples by Standard Methods or EPA 335**
     - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

       - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements

or the laboratory can analyze the samples as delivered and qualify the results in the final report.

- It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

- The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

7) 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 (2 working days) remaining on the holding time 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.

8) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply this blank with the bottle order.

9) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

10) Recommendations for packing samples for shipment.

- Pack samples in Ice rather than “Blue” ice packs.

- Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.

- Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.

- Fill extra cooler space with bubble wrap.

Figure 23-3.
Example: Cooler Receipt Form (Optional)

BF-SC-LF-003
Rev. 1
6/10/2013

SAMPLE LOGIN

Project_____Event _____

Analysis Groups_____

TAT ____ # SAMPLES: _____ TRIP BLANK? Y/N ___ #/date _____

Custody Seal Intact Y/N NONE Rad Check <0.02 mR/hr Y/N

Residual Chlorine Check Y/N/ NA Pres Checked Y/N/NA

Workshare/Subcontract Y/N Lab_____ _____ SO/ICOC #_____

Received out of hold: Samples _____Analysis_____

Checklist/NCM's_____

Temperature(s) #of coolers_____ IR Gun 1 2 3

RUSH **TIME CRITICAL**

Section 24.0

ASSURING THE QUALITY OF TEST RESULTS

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. Quality control samples are to be treated in the exact same manner as the associated field samples being tested. 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.

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.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
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.

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Table 24-1.

Control Type	Details
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.
Trip Blank [1]	Are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan) 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. (TNI)
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) (Matrix spikes are not applicable to air) 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 may be 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). In order to meet this requirement, TestAmerica Buffalo spikes with the Corporate Standard Standards primary mix for each analysis. 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 24-5. 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.

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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). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable.

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 data points are inspected and, using professional judgment, the limits 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. This process is outline in BF-QA-002.

24.6.4.1 The control limits are maintained in the laboratory LIMs system. The limits for each analyte/method/matrix combination are assigned effective and expiration dates. The QA department is able to query the LIMs system and print an active list of control limits based on this database. The most current laboratory limits (based on the effective/expiration dates) are reflected on the laboratory worksheets and final reports unless superseded by project specific limits.

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 13) 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.

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 22.

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 19.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25.0

REPORTING RESULTS

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. A variety of report formats are available to meet specific needs. 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.

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.

The laboratory complies with any state reporting requirements. An example is located in BF-PM-008 – Massachusetts DEP Notification Procedures.

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 on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) with a "sample results" column header.

25.2.2 Each report cover page is 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 # / ##. 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.

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 client 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 (if requested).

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). Sample temperatures are recorded in the report case narrative and on the COC. Deviations from normal conditions (e.g., preservation, breakage) are recorded in the report case narrative.

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Authorized signatories are qualified Project Managers appointed by the Manager of Project Managers.

25.2.21 When NELAP accreditation is required, the lab shall certify that the test results meet all requirements of NELAP or provide reasons and/or justification if they do not.

25.2.22 The laboratory includes a cover letter.

25.2.23 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.

25.2.24 When Soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.25 Appropriate laboratory certification number for the state of origin of the sample if applicable.

25.2.26 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.

25.2.27 Any non-TestAmerica subcontracted analysis results are provided as an addendum to the 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.

25.2.28 Certification Summary report, where required, will document that unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

25.3 REPORTING LEVEL OR REPORT TYPE

TestAmerica Buffalo 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 1 is a report with all of the elements outlined in Section 25.2 above, excluding 25.2.15 (QC data)
- Level II is a Level I report plus summary information, including results for the method blank, 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 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. Procedures used to ensure client confidentiality are outlined in Section 26.7.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services in addition to the test report as described in section 25.2. When NELAP accreditation is required and both a test report and EDD are provided to the client, the official version of the test report will be the combined information of the report and the EDD . TestAmerica Buffalo offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Excel, Dbase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the PM 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.

25.4 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

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.4.2 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 TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.4.4 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.

25.5 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 Section 8.

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.

25.6 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.

25.6.1 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. It is our policy that facsimiles are

intended for and should be used for business purposes only. 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 the sender.

25.7 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.

25.8 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 Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "R". The revised report will have the word "revised" appended to the cover letter.

When the report is re-issued, a notation of "revised" is placed on the cover/signature page of the report. A brief explanation of reason for the re-issue is included in the report case narrative.

25.9 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.9.1 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.

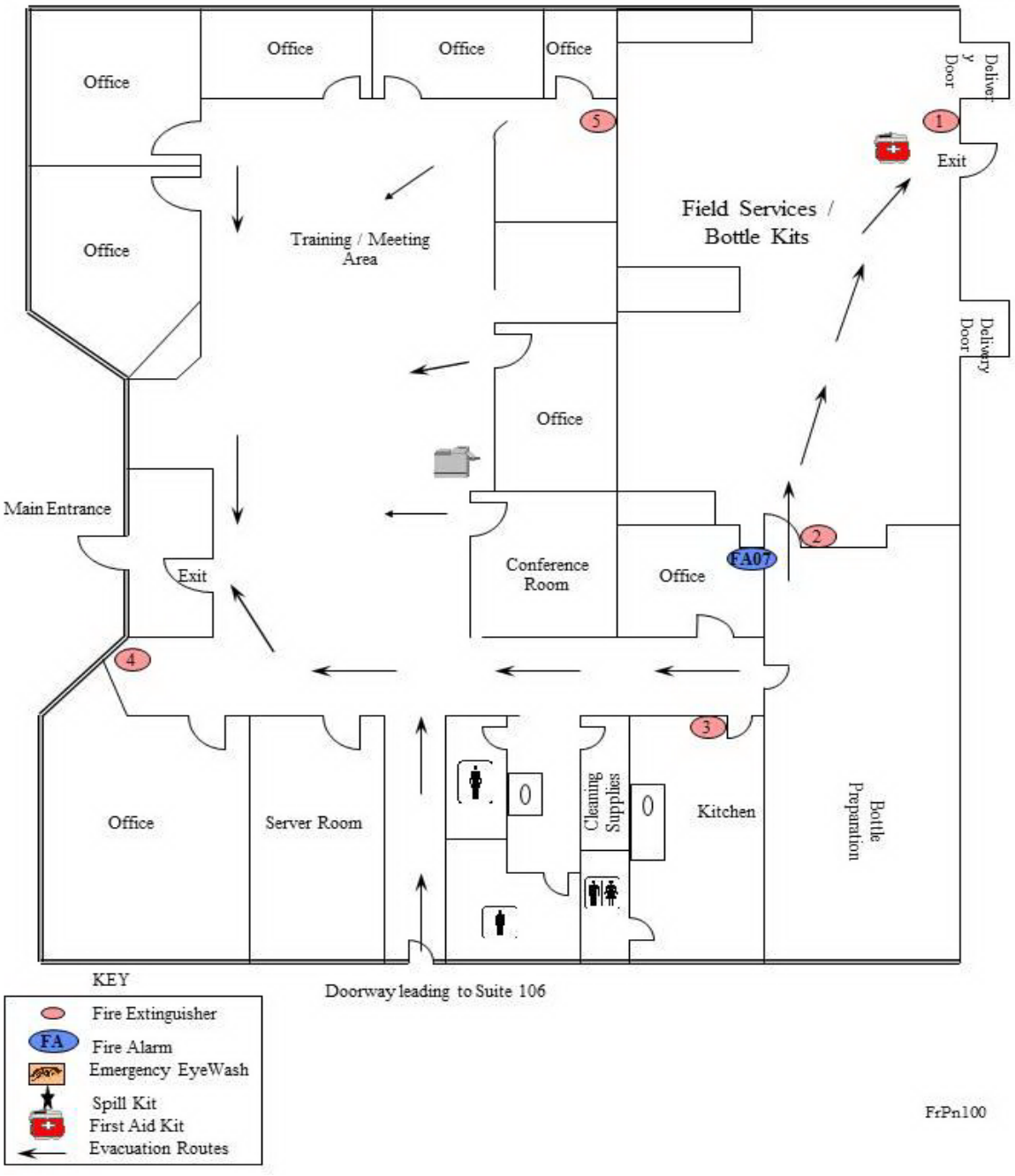
25.9.2 Multiple Reports

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.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 100
FLOOR PLAN



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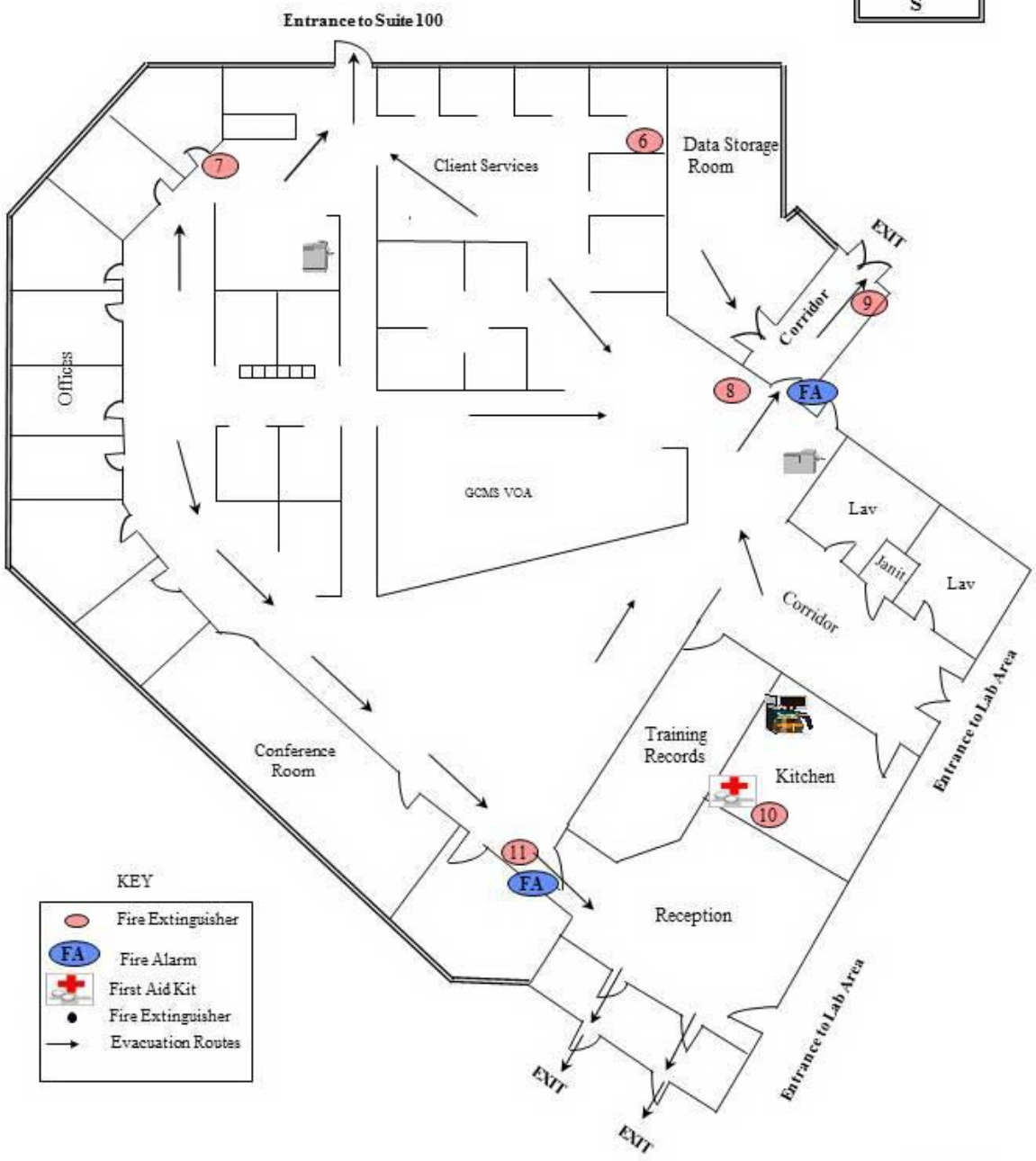
TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 106
CLIENT SERVICES/REPORT PREP
FLOOR PLAN



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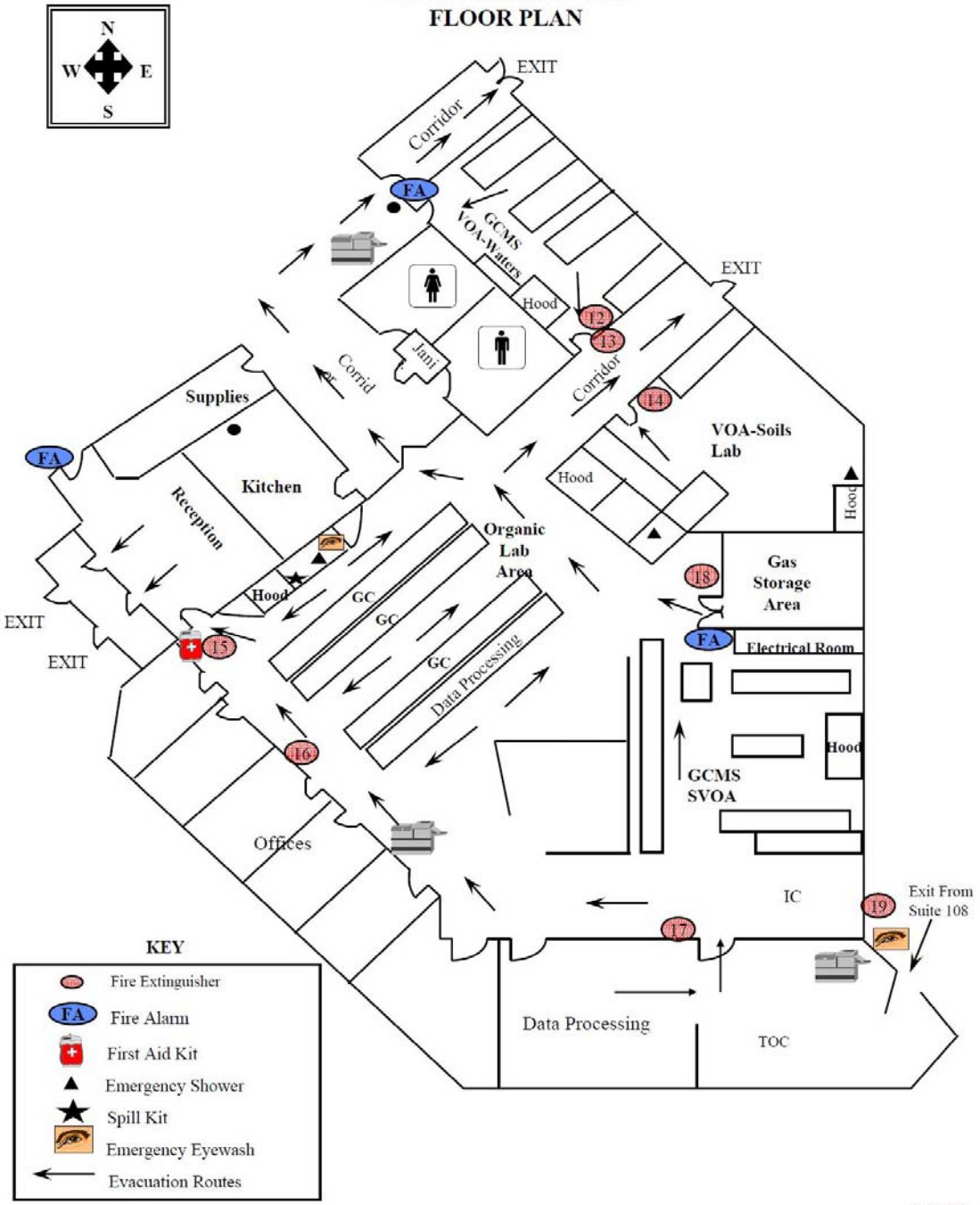
THE LEADER IN ENVIRONMENTAL TESTING

TAL BUFFALO
HAZELWOOD DR. NY OFFICES, SUITE 106
LABORATORY AREA
FLOOR PLAN



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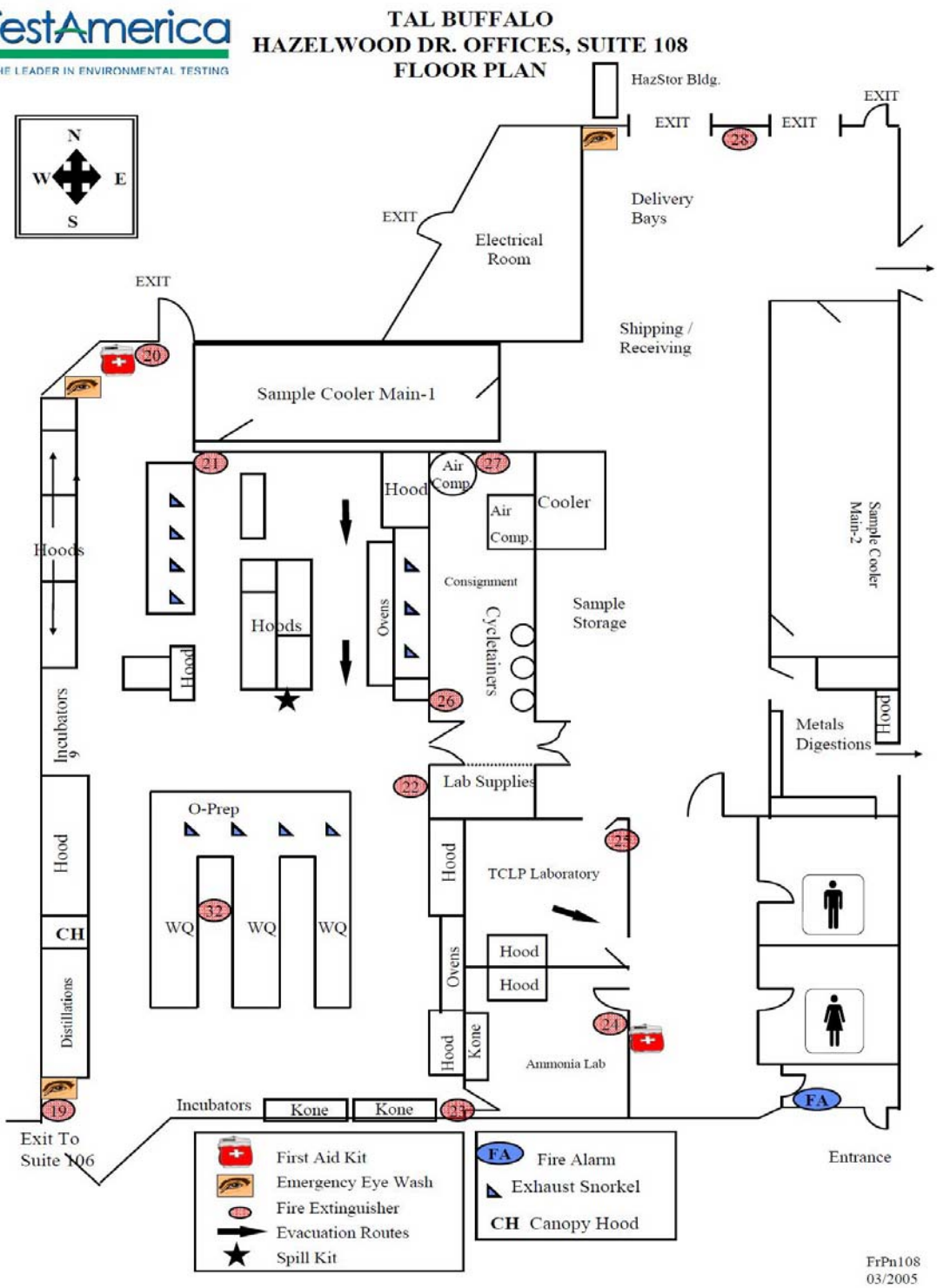
TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING
TAL BUFFALO
HAZELWOOD DR. OFFICES, SUITE 108
FLOOR PLAN
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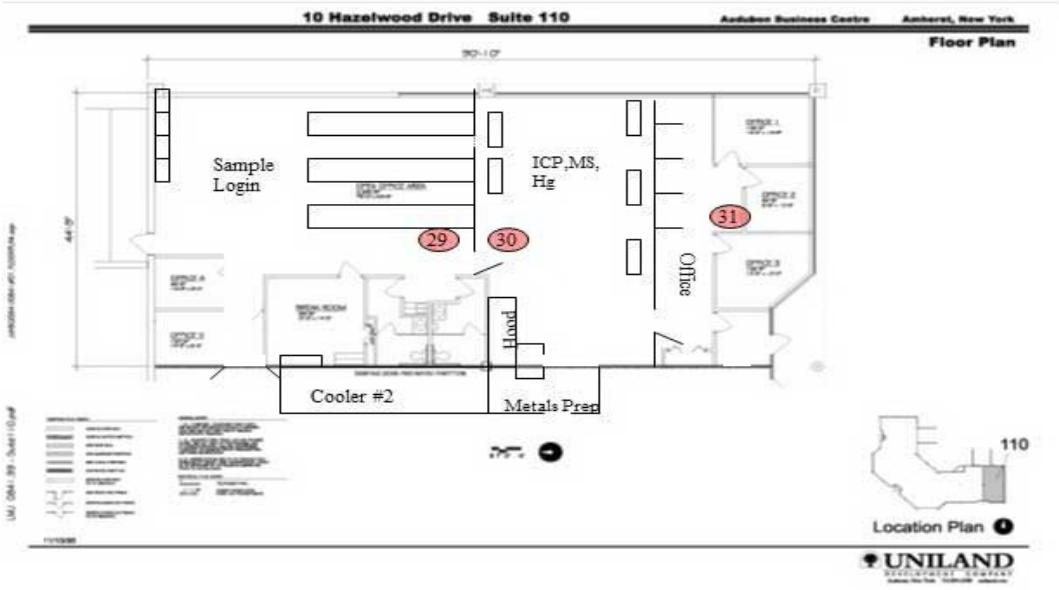
FrPn108
03/2005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UNILAND

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. (TNI)

Accrediting Authority: The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (TNI)

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. (TNI)

Analytical Uncertainty: A subset of Measurement Uncertainty that includes all laboratory activities performed as part of the analysis. (TNI)

Anomaly: A condition or event, other than a deficiency, that may affect the quality of the data, whether in the laboratory's control or not.

Assessment: The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of laboratory accreditation). (TNI)

Audit: A systematic and independent examination of facilities, equipment, personnel, training, procedures, record-keeping, data validation, data management, and reporting aspects of a system to determine whether QA/QC and technical activities are being conducted as planned and whether these activities will effectively achieve quality objectives. (TNI)

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. (TNI)

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)

Calibration: A set of operations that establish, under specified conditions, the relationship between values of quantities indicated by a measuring instrument or measuring system, or values represented by a material measure or a reference material, and the corresponding values realized by standards. (TNI)

1) In calibration of support equipment the values realized by standards are established through the use of reference standards that are traceable to the International System of Units (SI).

2) In calibration according to methods, the values realized by standards are typically established through the use of Reference Materials that are either purchased by the laboratory with a certificate of analysis or purity, or prepared by the laboratory using support equipment that has been calibrated or verified to meet specifications.

Calibration Curve: The mathematical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (TNI)

Calibration Standard: A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM): A reference material, accompanied by a certificate, having a value, measurement uncertainty, and stated metrological traceability chain to a national metrology institute. (TNI).

Chain of Custody (COC) Form: Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; the collector; time of collection; preservation; and requested analyses. (TNI)

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. (TNI)

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. TNI 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
Derivitization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures
(TNI)

Conformance: An affirmative indication or judgment 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)

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). (TNI)

Data Reduction: The process of transforming the number of data items by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (TNI)

Deficiency: An unauthorized deviation from acceptable procedures or practices, or a defect in an item (ASQC), whether in the laboratory's control or not.

Demonstration of Capability: A procedure to establish the ability of the analyst to generate analytical results of acceptable accuracy and precision. (TNI)

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)

Equipment Blank: Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)

External Standard Calibration: Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

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 Accreditation: Those matrix, technology/method, and analyte combinations for which the accreditation body offers accreditation.

Holding Times: The maximum time 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 as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (TNI)

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)

Instrument Detection Limit (IDL): The minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific instrument. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. The IDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ± 100%. The IDL represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

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 of the procedure unless otherwise noted in a reference method. 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.

Least Squares Regression (1st 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(s) of Detection (LOD) [a.k.a., Method Detection Limit (MDL)]: A laboratory's estimate of the minimum amount of an analyte in a given matrix that an analytical process can reliably detect in their facility. (TNI)

LOD Verification [a.k.a., MDL Verification]: A processed QC sample in the matrix of interest, spiked with the analyte at no more than 3X the LOD for single analyte tests and 4X the LOD for multiple analyte tests and processed through the entire analytical procedure.

Limit(s) of Quantitation (LOQ) [a.k.a., Reporting Limit]: The minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be reported with a specified degree of confidence. (TNI)

(QS) 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 & Emissions: 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. (TNI)

Matrix Spike (spiked sample or fortified sample): A sample prepared, taken through all sample preparation and analytical steps of the procedure unless otherwise noted in a referenced method, by adding a known amount of target analyte to a specified amount of sample for which

an independent test result 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 Spike Duplicate (spiked sample or fortified sample duplicate): A replicate matrix spike prepared and analyzed to obtain a measure of the precision of the recovery for each analyte.

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. (TNI)

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. (TNI)

Non-conformance: An indication, judgment, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Observation: A record of phenomena that (1) may assist in evaluation of the sample data; (2) may be of importance to the project manager and/or the client, and yet not at the time of the observation have any known effect on quality.

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. (TNI)

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. (TNI)

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. (TNI)

Preservation: Any conditions under which a sample must be kept in order to maintain chemical and/or biological integrity prior to analysis. (TNI)

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. (TNI) [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. (TNI)

Proficiency Test Sample (PT): A sample, the composition of which is unknown to the laboratory and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (TNI)

Quality Assurance: An integrated system of management activities involving planning, implementation, assessment, reporting and quality improvement to ensure that a process, item, or service is of the type of quality needed and expected by the client. (TNI)

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 that measures the attributes and performance of a process, item, or service against defined standards to verify that they meet the stated requirements established by the customer; operational techniques and activities that are used to fulfill requirements for quality; also the system of activities and checks used to ensure that measurement systems are maintained within prescribed limits, providing protection against "out of control" conditions and ensuring that the results are of acceptable quality. (TNI)

Quality Control Sample: A sample used to assess the performance of all or a portion of the measurement system. One of any number of samples, such as Certified Reference Materials, a quality system matrix fortified by spiking, or actual samples fortified by spiking, intended to demonstrate that a measurement system or activity is in control. (TNI)

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. (TNI)

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 activities. (TNI)

Raw Data: The documentation generated during sampling and analysis. This documentation includes, but is not limited to, field notes, electronic data, magnetic tapes, untabulated sample results, QC sample results, print outs of chromatograms, instrument outputs, and handwritten records. (TNI)

Record Retention: The systematic collection, indexing and storing of documented information under secure conditions.

Reference Material: 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. (TNI)

Reference Standard: Standard used for the calibration of working measurement standards in a given organization or a given location. (TNI)

Sampling: Activity related to obtaining a representative sample of the object of conformity assessment, according to a procedure.

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: The ability to analyze, distinguish, and determine a specific analyte or parameter from another component that may be a potential interferent or that may behave similarly to the target analyte or parameter within the measurement system. (TNI)

Sensitivity: The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (TNI)

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.

Standard: The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of standard setting and meets the approval requirements of standard adoption organizations procedures and policies. (TNI)

Standard Operating Procedures (SOPs): A written document which details the method for an operation, analysis, or action with thoroughly prescribed techniques and steps. SOPs are officially approved as the methods for performing certain routine or and which is accepted as the method for performing certain routine or repetitive tasks. (TNI)

Storage Blank: A blank matrix stored with field samples of a similar matrix (volatiles only) that measures storage contribution to any source of contamination.

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)

Technical Manager: A member of the staff of an environmental laboratory who exercises actual day-to-day supervision of laboratory operations for the appropriate fields of accreditation and reporting of results

Technology: A specific arrangement of analytical instruments, detection systems, and/or preparation techniques.

Traceability: The ability to trace the history, application, or location of an entity by means of recorded identifications. In a calibration sense, traceability relates measuring equipment to national or international standards, primary standards, basic physical constants or properties, or reference materials. In a data collection sense, it relates calculations and data generated throughout the project back to the requirements for the quality of the project. (TNI)

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:

CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
DOC – Demonstration of Capability
DQO – Data Quality Objectives
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
ICP/MS-ICP/Mass Spectrometry
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
LOD – Limit of Detection

LOQ – Limit of Quantitation
MDL – Method Detection Limit
MDLCK – MDL Check Standard
MDLV – MDL Verification Check Standard
MRL – Method Reporting Limit Check Standard
MS – Matrix Spike
MSD – Matrix Spike Duplicate
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
SDS - Safety Data Sheet
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
TNI – The NELAC Institute
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3. Laboratory Certifications, Accreditations, Validations

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TestAmerica Buffalo 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:

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Certifications

Laboratory	Program	Authority	Identification	Expiration Date
TestAmerica Buffalo	Federal	USDA	P330-11-00386	11/26/2017
TestAmerica Buffalo	NELAP	Florida	E87672	06/30/2017
TestAmerica Buffalo	NELAP	Illinois	200003	09/30/2016
TestAmerica Buffalo	NELAP	Kansas	E-10187	10/31/2016
TestAmerica Buffalo	NELAP	Louisiana	02031	06/30/2017
TestAmerica Buffalo	NELAP	Minnesota	036-999-337	12/31/2016
TestAmerica Buffalo	NELAP	New Jersey	NY455	06/30/2017
TestAmerica Buffalo	NELAP	New York	10026	03/31/2017
TestAmerica Buffalo	NELAP	Oregon	NY200003	06/09/2017
TestAmerica Buffalo	NELAP	Pennsylvania	68-00281	07/31/2017
TestAmerica Buffalo	NELAP	Texas	T104704412-15-6	07/31/2017
TestAmerica Buffalo	NELAP	Virginia	460185	09/14/2017
TestAmerica Buffalo	NELAP Primary AB	New Hampshire	2973	09/11/2017
TestAmerica Buffalo	NELAP Secondary AB	New Hampshire	2337	11/17/2016
TestAmerica Buffalo	State Program	Arkansas DEQ	88-0686	07/06/2017
TestAmerica Buffalo	State Program	California	1169CA	09/30/2017
TestAmerica Buffalo	State Program	Connecticut	PH-0568	09/30/2016
TestAmerica Buffalo	State Program	Georgia	956	03/31/2017
TestAmerica Buffalo	State Program	Georgia	N/A	03/31/2017
TestAmerica Buffalo	State Program	Iowa	374	03/01/2017
TestAmerica Buffalo	State Program	Kentucky (DW)	90029	12/31/2016
TestAmerica Buffalo	State Program	Kentucky (UST)	30	03/31/2017
TestAmerica Buffalo	State Program	Kentucky (WW)	90029	12/31/2016
TestAmerica Buffalo	State Program	Maine	NY00044	12/04/2016
TestAmerica Buffalo	State Program	Maryland	294	03/31/2017
TestAmerica Buffalo	State Program	Massachusetts	M-NY044	06/30/2017
TestAmerica Buffalo	State Program	Michigan	9937	03/31/2016 *
TestAmerica Buffalo	State Program	North Dakota	R-176	03/31/2017
TestAmerica Buffalo	State Program	Oklahoma	9421	08/31/2017
TestAmerica Buffalo	State Program	Rhode Island	LAO00328	12/30/2016
TestAmerica Buffalo	State Program	Tennessee	TN02970	03/31/2017
TestAmerica Buffalo	State Program	Washington	C784	02/10/2017
TestAmerica Buffalo	State Program	West Virginia DEP	252	09/30/2016
TestAmerica Buffalo	State Program	Wisconsin	998310390	08/31/2017

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* Certification Valid - Laboratory is Pending Renewal with the Program Authority

For more information, or to contact a local TestAmerica representative nearest you, please visit our website at www.testamericainc.com

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The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.

APPENDIX G
SITE MANAGEMENT FORMS

Property Inspection Form
Rockaway Park Former MGP Site

SITE INSPECTION DATE: _____ **TIME OF ARRIVAL:** _____

DEPARTURE: _____

WEATHER: _____

_____

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 / NA

_____

_____

_____

Has ownership of the property changed since the last inspection? Yes / No

(Verify with Real Estate and Survey Departments)

_____

_____

_____

_____

Are there any changes to LIPA GO-10421 Excavation within Substations which would effect the SMP or institutional controls? Yes / No

_____

_____

_____

_____

_____

_____

_____

nationalgrid

Property Inspection Form
Rockaway Park Former MGP Site

Are the Engineering Controls in place, performing properly, and remain effective?

Site Fencing in Place and in Good Condition? Yes / No

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.)

Monitoring Wells Intact (ie no evidence of damage to casings/roadboxes, new paving,) Yes / No

NOTE:

Inspections should be made a minimum once a year and within 5 days of an emergency, such as a natural disaster or an unforeseen failure or damage to the building occurs). Inspections will be conducted by National Grid SIR (or their agent) with assistance from LIPA.

COMPLETED BY:	**REVIEWED BY:**
SIGNATURE:	**SIGNATURE:**

nationalgrid

APPENDIX H – FIELD SAMPLING PLAN

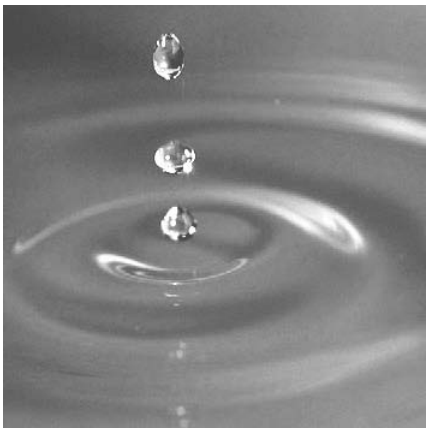
GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Field Sampling Plan

National Grid - Long Island, New York Sites

Prepared By:
GEI Consultants, Inc.
110 Walt Whitman Road, Suite 204
Huntington Station, New York 11746



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- FD-002 Daily Report
- FD-003 Sample Handling and Chain of Custody
- FD-004 Photo Documentation
- FD-005 Surveying and Mapping Specifications
- FD-006 Handheld Global Positioning Receiver Operation

Section 4 – Drilling Methods (DM)
- DM-001 General Guidance on Determination of Appropriate Drilling Methods
- DM-002 Hollow-Stem Auger
- DM-003 Sonic Drilling
- DM-004 Drive and Wash
- DM-005 GeoProbe ® Direct Push Boring
- DM-006 Monitoring Well Construction and Installation
- DM-007 Monitoring Well Telescoping
- DM-008 Monitoring Well Development
- DM-009 General Guidance on Monitoring Well Abandonment

Section 5 – Sample Collection and Field Screening (SC)
- SC-001 General Guidance on Sample Collection
- SC-002 Sample Handling
- SC-003 Investigation Derived Waste
- SC-004 Head Space VOC Screening
- SC-005 SiteLAB ™ UVF-3100 Ultraviolet Fluorescence (UVF) Detection Method

Section 6 – Solid Matrix Sampling (SM)
- SM-001 Soil Sampling Techniques Including Split-Spoon
- SM-002 VOC Soil Collection and Preservation Method
- SM-003 Soil Classification
- SM-004 Test Pit Excavation
- SM-005 Underground Storage Tank (UST) Removal and Closure Process

Section 7 – Groundwater (GW)

GW-001 Water Level Measurement
GW-002 Non-Aqueous Phase Liquid (NAPL) Measurement
GW-003 Low Flow (Low Stress) Groundwater Sampling
GW-004 pH and Temperature Measurement
GW-005 Turbidity Measurement
GW-006 Specific Conductance Measurement
GW-007 Dissolved Oxygen Measurement
GW-008 Temporary Groundwater Sampling Points
GW-009 Potable Well Sampling
GW-010 Slug Test
GW-011 Open Sandpipe Piezometer Construction and Installation
GW-012 Vibrating Wire Piezometer Construction and Installation

Section 8 – Surface Water Sampling (SW)

SW-001 Surface Water Sampling

Section 9 – Sediment Sampling (SS)

SS-001 Water Safety
SS-002 Ponar or Shipek Grab Sampler
SS-003 Sediment Sampling Using Vibracore Equipment
SS-004 Remote Sediment Sampling

Section 10 – Air Sampling and Monitoring (AR)

AR-001 General Guidance on Community Air Monitoring Methods
AR-002 Perimeter Air Monitoring Method (Classic/Lite Monitoring Station)
AR-003 Polyaromatic Hydrocarbons (PAHs) in Ambient Air Method TO-13A
AR-004 Hydrogen Cyanide Work Zone Air Monitoring Procedures
AR-005 zNose® Monitoring

Section 11 – Soil Gas Sampling (SG)

SG-001 General Guidance on Soil Vapor Intrusion Evaluations
SG-002 Soil Vapor Sample Collection
SG-003 Sub-Slab Soil Vapor Collection
SG-004 Ambient Air Sample Collection

Section 12 – Quality Control – Quality Assurance (QA)

QA-001 Equipment Decontamination
QA-002 Field and Laboratory Quality Control Procedures

Acronyms and Abbreviations

ACGIH	American Conference of Industrial Hygienists
AOC	Area of Concern
ASTM	American Society for Testing and Materials
BOD	Biological Oxygen Demand
BTEX	Benzene, Toluene, Ethyl Benzene, Xylenes
CAMP	Community Air Monitoring Plan
CD	Corrected Depth
CERCLA	Comprehensive Environmental Response, Cleanup, and Liability Act
CFR	Code of Federal Regulations
COC	Chain of Custody
DL	Detection Limit
DNAPL	Dense Non-Aqueous Phase Liquid
DO	Dissolved Oxygen
DOT	Department of Transpsortation
DQO	Data Quality Objectives
EC	Engineering Controls
EIS	Environmental Impact Study
EM	Electro-Magnetic
EPA	Environmental Protection Agency
FID	Flame Ionization Detector
FS	Feasiblity Study

FSP	Field Sampling Plan
FWRIA	Fish and Wildlife Resources Impact Analysis
GAC	Granular Activated Carbon
GC/MS	Gas Chromatograph/Mass Spectrometer
GFAA	Graphite Furnace Atomic Absorption Spectrometry
GIS	Geographic Information Systems
GPR	Ground Penetrating Radar
GPS	Global Positioning System
HASP	Health and Safety Plan
HDPE	High Density Polyethylene
HMI	Human Machine Interface
HOC	Halogenated Organic Compound
HPLC	High Pressure Liquid Chromatography
HSAs	Hollow-Stem Augers
HSO	Health and Safety Officer
HVAC	Heating Ventilating Air Conditioning
IATA	International Air Transport Association
IC	Institutional Controls
ICP	Inductively Coupled Plasma Atomic Emission Spectrometry
ID	Inner Diameter
IDW	Investigation Derived Waste
IHC	In-House Consultants

JHS	Jar Head Space
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Phase Liquid
MC	Macrocore®
MCL	Maximum Contaminant Level (for EPA Drinking Water Standards)
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MS/MSD	Matrix Spiked/Matrix Spiked Duplicate
MSDS	Material Safety Data Sheet
MTBE	Methyl Tert-Butyl Ether
NAPL	Non-aqueous Phase Liquids
NAVD	North American Vertical Datum
NCP	National Contingency Plan
NOAA	National Oceanic and Atmospheric Adminstration
NPL	National Priority List
NYSDEC	New York State Department of Environmental Conservation
OD	Outer Diameter
ORP	Oxidation-Reduction Potential
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl

PFD	Personal Floating Device
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
PUF	Polyurethane Foam
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance / Quality Control
QAPP	Quality Assurance Project Plan
QHEA	Qualitative Human Exposure Assessment
RAO	Remedial Action Objectives
RAP	Remedial Action Plan
RCRA	Resource Conservation Recovery Act
RD	Remedial Design
RFP	Request For Proposal
RI	Remedial Investigation
RP	Responsible Party
SARA	Superfund Amendments and Reauthorization Act
SAW	Surface Acoustic Wave
SC	Specific Conductance
SC (Section 11)	Site Characterization
SCGs	Standards, Criteria, and Guidance
SMP	Site Management Plan
SOP	Standard Operating Procedure

SOW	Scope of Work or Statement of Work
SPLP	Synthetic Precipitate Leaching Procedure
SPT	Standard Penetration Test
STEL	Short-Term Exposure Limit
SVE	Soil Vapor Extraction
SVOC	Semi-Volatile Organic Compounds
SWMU	Solid Waste Management Unit
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Indentified Compound from Mass Spectrometry
TLV	Threshold Limit Value
TOC	Total Organic Carbon
TOSCA	Toxic Substance Control Act
TPH	Total Petroleum Hydrocarbons
TVOC	Total Volatile Compounds
TWA	Time Weighted Average
UFV	Ultraviolet Fluorescence
USACE	United States Army Corps of Engineers
USCS	Unified Soil Colassification System
USEPA	United States Environmental Protection Agency
USGS	United States Geologic Survey
UST	Underground Storage Tank
UTM	Universal Transverse Mercator

VC	Vibracore
VOC	Volatile Organic Compounds
WAAS	Wide Area Augmentation System
WAFs	Work Authorization Forms
WP	Work Plan
XRF	X-Ray Fluorescence

Measurements

bgs	Below Ground Surface
ft	Feet or Foot
g	Grams
lpm	Liters per minute
Mf/L	Million fibers per liter
mg/kg	Milligram per kilogram
mg/L	Milligram per liter
mil	0.001-inch
ml	Milliliter
mL/min	Milliliters per minute
msl	Mean Sea Level
mV	Millivolt
ng	Nanogram
NTUs	Nephelometric Turbity Units
PM-2.5	2.5 Microns
PM-10	10 Microns
ppb	Parts per billion
ppbv	Parts per billion by volume
ppm	Parts per million
ppmv	Parts per million by volume
psi	Pounds per square inch
µg	Microgram

µg/Kg	Microgram per kilogram
µg/L	Microgram per liter

Section 1

INTRODUCTION

1. Introduction

This document serves as a Field Sampling Plan (FSP) for various types of environmental sampling activities that may be utilized during implementation of Site Characterizations, Remedial Investigations, Interim Remedial Measures, Feasibility Studies, Remedial Designs, and/or Remedial Actions at National Grid sites in Long Island, New York. The primary intent of this document is to promote accuracy and consistency for field and office support operations.

This FSP encompasses a broad range of activities to improve the planning, implementation, and documentation of field and pertinent office operations. All methodologies presented in this document may not be applicable to site-specific situations. In the event of differences between the FSP and any site-specific work plan, including a work plan or a quality assurance project plan, the provisions of the site-specific plan will prevail.

This document is organized according to the chronological sequence of typical work flow proceeding from project setup to field activities and then to data collection.

The document contains two types of guidance:

General Guidance Procedures – Documents intended to be informative and not prescriptive. The documents are designed to provide necessary background information to adequately understand associated field processes.

Standard Operating Procedures (SOPs) – Documents intended to provide the necessary procedures and notes to successfully implement the operation.

This FSP incorporates requirements including but not limited to New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation dated May 3, 2010, any applicable local, state, or federal requirements, and National Grid requirements. Each SOP is current as of the effective date indicated in the header and will be updated as necessary.

This document has been provided to all staff performing field tasks for National Grid sites in Long Island, New York.

2. FSP Layout Design

2.1 Header Information

i. Each SOP contains, within its designation, a two letter abbreviation of the general category in which it belongs (i.e. PP-001 means it is in Project Planning). The table of contents provides the definition

for each abbreviation. The SOP name and number is provided in the header and footer of the document. As discussed in the previous section, GEI guidance documents are not given an SOP reference number.

ii. The revision number is provided in the header of each SOP.

iii. The effective date is provided in the header of each SOP. The effective date provides the date when the revisions to the SOP are in effect and provides information as to the last time the SOP was updated. Each SOP should contain the most up-to-date version and effective date.

2.2 Footer Information

i. Each footer contains the page number and total page numbers as well as a second reference to the SOP name.

2.3 Body of Text

i. Details of the SOP are provided sequentially.

ii. Notes are provided to understand precautions or common issues associated with the performance of the procedure.

iii. References provide sources for the creation of the SOP.

iv. Attachments provide reference to external documentation that could be reviewed in conjunction with the document.

v. Hyperlinks have been embedded in the document to assist with navigation throughout the document. Reference and inclusion of complete SOPs are included within this document. Each SOP should contain the most up-to-date version and revision date.

Section 2

PROJECT PLANNING ACTIVITIES (PP)

SUMMARY GUIDANCE

PP-001 General Guidance on Project Planning Activities

1. Objective

The purpose of this summary guidance section is to present a summary of the project planning activities that must be completed prior to the start of field activities. The following text outlines the steps which should be followed.

To begin, the task-specific work plan should be reviewed to identify the specifics of the task to be completed. This includes the type of work, sampling requirements, and schedule, among others. A site visit (if possible) should be made to verify that sample locations are accessible. Once the review of the work plan is completed, it can then be determined which steps need to be taken to start the project. A project planning checklist (see attached) should be completed and includes the items detailed below

2. Execution

- **Subcontractor Selection** – If the subcontractor is to be contracted through GEI, the subcontractor should be selected based on a combination of their qualifications and their proposed costs, if not identified in the Master Services Agreement. A minimum of two subcontractor cost proposals should be obtained for each task. The subcontractor selected to provide cost proposals should be on National Grid's approved list (listed in the site-specific Work Authorization Forms [WAFs]), otherwise prior approval will be necessary.
- **Subcontractor Agreement –** Once a subcontractor is selected, a subcontractor agreement between GEI and the subcontractor must be established. This agreement is task specific and should reference an approved proposal from the subcontractor.
- **Markouts –** If the project includes intrusive work, a utility markout request must be called in to Dig Net (811). Markouts must be called in at least 72 hours prior to the start of intrusive activities; however, five business days is recommended. If the work conducted is on private property, markouts by a private markout company should be obtained as public utility locating services will generally only identify line point-of-entry to a private property from a right-of-way. Markout verifications from Dig Net must be received at least one day prior to the start of field activities. Following the receipt of the markout verifications, a National Grid required markout verification spreadsheet and the GEI utility clearance form must be completed, and the markouts must be visually verified. The markout verifications, verification spreadsheet and the GEI utility clearance forms must be compiled and remain onsite during the duration of intrusive activity. In addition, markouts must be

checked every 10 days throughout the duration of intrusive work. For more information on markouts, please see SOPs PP-002 and PP-003.

- **Health and Safety –** A site-specific Health and Safety Plan (HASP) must be developed prior to any field work. The site-specific HASP must be reviewed by the staff involved in the project and signed prior to the start of work (by field staff). Subcontractors are required to provide their own HASPs (which are at a minimum, as strict as the GEI HASP), or must sign and comply with the GEI site-specific HASP. The subcontractor must also provide the proper certifications for the field crew, which should include, but is not limited to, OSHA certifications (8-hour and 40-hour HAZWOPER) and medical clearance documentation. In addition, tailgate safety meetings must be held daily, which discuss hazards related to the task being performed. For more information, please refer to the site-specific HASP. For the SOPs presented in this FSP, health and safety items must be adhered to during the conduct of all field activities.
- **National Grid Notifications –** prior to the scheduling of field activities, all team members should be identified. The appropriate National Grid project manager should be notified as soon as possible of the upcoming work and the proposed schedule. As a general rule, at least one week notice should be provided. National Grid will coordinate access to any private property where sampling is planned to be conducted.
- **Data Group Notification –** GEI's Data Group should be notified if laboratory analysis is to be performed. The Data Group should be made aware of the types of analysis being performed, the approximate number of samples to be collected, the validation requirements and turnaround times.
- **Lab Notification –** If laboratory analysis is needed, the selected laboratory should be notified as soon as possible to order the necessary sample bottles and supplies. They also should be informed of the anticipated amount of samples, type of analysis and required turnaround times.
- **Equipment –** Any specialized equipment or supplies, including Community Air Monitoring Program (CAMP) equipment, needed for the job should be ordered, to allow for sufficient lead time. CAMP equipment is required for any intrusive work. For more information on CAMP requirements, please see the site-specific HASP or Work Plan and SOPs AR-001 through AR-005.
- **Investigation Derived Waste (IDW) Management –** Consideration should be given to the management of IDW. Based on the work to be performed at the specific site, a determination needs to be made on how the IDW is to be handled. Possibilities include drums for soil and groundwater, frac tanks for groundwater or roll-offs for soil. Reducing

the amount of IDW generated through selection of the appropriate sampling and investigation methods, as well as cost and efficiency of disposal, should always be considered.

- **Background Information –** Prior to field activities, pertinent background information should be discussed with the field staff and GEI task and project managers. Such information may include: historical perspective, property owner/community member interests, potential litigation matters, access and logistical issues, safety concerns, National Grid requirements and concerns, among others.
- **As indicated above, prior to initiation of field activities, all National Grid requirements and concerns must be implemented and understood by GEI staff.**
- **Kick-off Meeting –** A kick-off meeting should be conducted prior to the start of field activities. At a minimum, the meeting should be attended by the project manager and field staff. This meeting should review the tasks to be completed, equipment needed, laboratory analysis, and a review of any necessary background information (including potential sensitivities associated with the site or work area of the site). Other items that should be discussed include the process of and the need to keep National Grid informed of the work progress (including any relevant observations) and the steps to be taken if a member of the field crew is approached/questioned by a regulator or a member of the public or media.

Attachment A

Project Planning Checklist
National Grid Sites
Long Island, New York

SITE: _____

PROJECT MANAGER: _____

Activity	Completed (Yes, No or NA)	Date Completed	Comments
Subcontractor Identified (if needed)			
Subcontractor agreement			
Markouts			
HASP			
Subcontractor certs obtained			
National Grid Notifications			
Data Group Notified			
Laboratory notified			
Equipment Ordered			
IDW Management			
Background info reviewed			
Kick-off meeting or call			

SUMMARY GUIDANCE

PP-002 General Guidance on Private Utility Markout

1. Overview

Prior to installing any wells, performing excavations or penetrating the subsurface for any investigation; all service lines, including water, electrical power, natural gas, sewers, cable and product distribution piping, and others, must be mapped out on the ground surface. This requirement is independent of the need for borehole clearing to 5 feet. Both exercises together minimize the safety risk as well as the time and cost penalty associated with severing an underground line.

This guidance describes and recommends technologies that should be (and normally are) employed from the companies performing the mapping, which are private utility locators. Public utility locating services will identify line point-of-entry from a right-of-way, but in many cases are unwilling to mark locations within the footprint of a site. Even if the public companies provide onsite service, it is good insurance to have a private company verify buried utility locations because of the potential consequences of hitting an unknown buried utility.

Because subsurface lines may be metal, plastic, clay, or concrete, multiple technologies are generally needed for their identification. For most applications the following technologies are fit-for-purpose.

Electro-Magnetic (EM) Device: This technology uses an electro-magnetic field in the subsurface to accurately locate metallic lines or non-metallic lines incorporating a metallic trace wire along their surface. The field is created either by direct contact to the pipe or trace wire, or by an induced current via radio waves.

Sewer Sonde: For non-metallic lines where internal access is possible (such as cleanout ports in a sewer), a beacon or 'sonde' that emits a signal to a surface receiver as it is snaked through the pipe provides the same accuracy as the EM detector. If the internal condition of the pipe is desired, a camera can be deployed instead of only a sonde.

Ground Penetrating Radar (GPR): This technology involves radar waves reflecting to a surface receiver which provides a visual real-time map of the subsurface by which anomalies (such as pipes or tanks) may be detected. It has limitations in clay or wet soils and requires a skilled operator for interpretation. For high risk utilities (e.g. PVC natural gas lines without trace

wire) where line-of-sight projection from site entry point to a kiosk or other building is uncertain, GPR should be considered.

For most sites, utility markouts using the above technologies can be conducted in about two hours, assuming work covers a limited area where subsurface activities will be conducted. Consideration should be given to mapping an entire site if as-built drawings are suspect and work is planned over an extended period of time.

SUMMARY GUIDANCE

PP-003 General Guidance on Maintaining Markouts

1. Overview

Maintain the marks set down by utility operators/ locators at your site. Several steps should be taken to ensure site markouts are maintained/refreshed throughout the project.

Walk-through the site to become familiar with the markings and the locations of buried utilities. Pay special attention to any changes in direction that the underground facilities take. Consider photographing the markouts.

If the excavation will cause the removal or disturbance of markings, establish offset marks in order to maintain a reference point for those underground facilities.

Make sure that everyone involved in your excavation is aware of any offsets that have been established, any marks that have been compromised, or any other information regarding facility locations.

Don't put spoil piles over markings.

If the markouts are located over grassy areas or if snow is expected, flags or stakes should be employed to avoid having the markouts washed away by rain or covered by snow.

Avoid driving machinery over stakes and flags. Paved areas should be swept periodically so that painted marks remain visible.

If marks have faded or have been compromised to the point where proper and safe excavation is no longer possible, call the public or private utility markout service and make a request for a new markout ticket. If the markings at your site are refreshed, make sure that you use the uniform color code.

Section 3

FIELD DOCUMENTATION (FD)

STANDARD OPERATING PROCEDURE

FD-001 Field Notebook

1. Objective

Proper documentation of all site activities is a crucial part of the field investigation process. Documentation, relative to sampling procedures, includes sample labels, sample seals, field logbooks, chain of custody (COC) records, sample analysis request forms, and laboratory sample logs. The field notebook serves as a record of significant field activities performed or observed during the project. The field notebook provides a factual basis for preparing field observation reports, if required, and reports to clients and regulatory agencies. Example field notes are provided in Appendix A.

2. Execution

- Use a separate all-weather bound notebook for each site/location/ project number, as appropriate.
- Write neatly using black or blue waterproof indelible pen (or note if field conditions [i.e., cold or wet weather] require use of pencil).
- Write the project name, project number, book number (i.e., 1 of 3), and date 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.
- Number all of the pages of the field book starting with the first entry if notebook is not numbered already.
- Record activities as they occur.
- 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.
- Sign or initial and date the bottom of the last daily page of an entry. Place a diagonal line through unused portions of a page.
- Record the following information upon each arrival at the site:
    1. Date/time/weather/project number.
    2. GEI personnel.
    3. Purpose of visit/daily objectives.
    4. Record conversations with:
        a. Contractors.
        b. National Grid.
        c. Visitors (include complete names, titles, and affiliations whenever possible).
        d. GEI office staff.

e. Landowners (site or abutters).

5. If possible, record telephone numbers of individual contacts for the site in the field notebook.
6. Note time of arrival and departure of individuals visiting the site.

- Potential additional observations to record (as needed):
    1. Type and quantity of monitoring well construction materials used.
    2. Use of field data sheets or electronic logging equipment (e.g. boring logs, monitoring well sampling logs, etc.).
    3. Ambient air monitoring data.
    4. Locations and descriptions of sampling points.
    5. Sample media (soil, sediment, groundwater, etc.).
    6. Sample collection method.
    7. Sample identification number(s) and date and time of sample collection.
    8. Approximate volume of groundwater removed before sampling.
    9. Field observations.
    10. Any field observations made such as pH, temperature, turbidity, conductivity, water level, etc.
    11. References for all maps and photographs of the sampling site(s).
    12. Information pertaining to sample documentation: bottle lot numbers/dates, method of sample shipments, COC record numbers, and overnight shipping numbers.
    13. Surveying data (including sketches with north arrows).
    14. Changes in weather.
    15. Rationale for critical field decisions.
    16. Recommendations made to the client representative and GEI Project Manager.
    17. Include a site sketch or representative site photograph of conditions at the end of the day, if required.
    18. Time.
    19. Summarize work completed/work remaining.

3. Notes

- Only record facts.
- Record all observations regardless of relevancy.
- Identify conditions or events that could affect/impede your ability to observe conditions.
- Do not use spiral notebooks because pages can be easily removed.

4. References

New Jersey DEP Field Sampling Procedures Manual, August 2005.

Yerington Mine Site SOP-03 Standard Operating Procedure Field Notes and Documentation, Revision 0 Revision Date: June 6, 2006.

ASFE Model Daily Field Report (1991), ASFE, Inc.

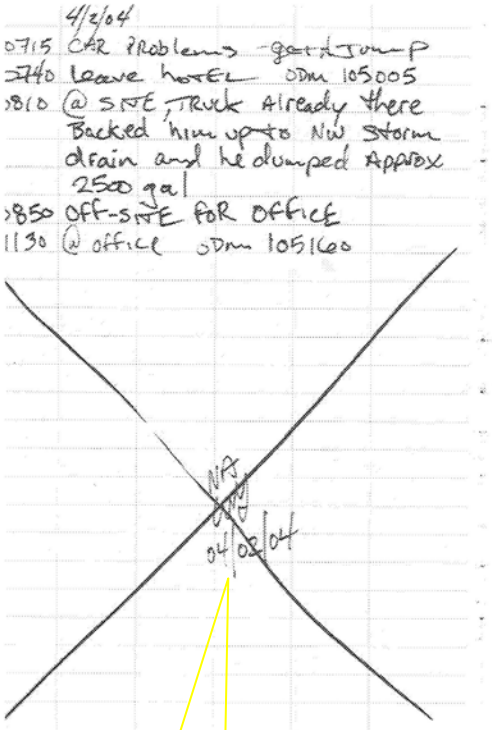
5. Attachments

Attachment A – Example Field Notes

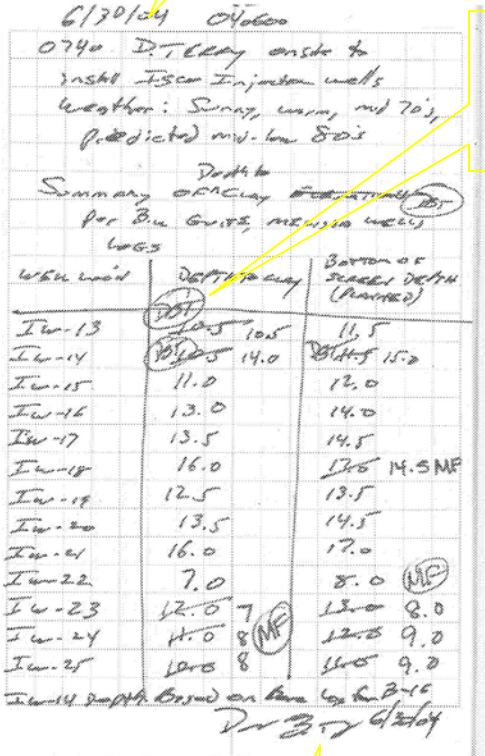
Attachment A

SOP FD-001

Attachment A – Example Field Notes



4/2/04
0715 CAR Problems - get a jump
0740 Leave hotel ODM 105005
0810 @ SITE, TRUCK Already there
Backed him up to NW Storm
drain and he dumped Approx
2500 gal
0850 Off-SITE for Office
1130 @ office ODM 105160



6/30/04
0740 D.T. Clay onsite to
install Tracer Injection wells
Weather: Sunny, warm, mid 70's,
predicted mid-low 80's
Summary of Clay Depths for Bore Holes and Well Logs

Well No.	Depth to Clay		Bottom of Seal Depth (Planned)
	DBT		
IW-13	10.5	10.5	11.5
IW-14	10.5	14.0	15.0
IW-15	11.0		12.0
IW-16	13.0		14.0
IW-17	13.5		14.5
IW-18	16.0		14.5 MF
IW-19	12.5		13.5
IW-20	13.5		14.5
IW-21	16.0		17.0
IW-22	7.0		8.0 MF
IW-23	12.0	7	13.0 8.0
IW-24	11.0	8 MF	12.0 9.0
IW-25	10.0	8	11.0 9.0

IW-14 Depth Based on Bore Log IW-16
DW 6/30/04

Start of each day includes:
- **Date**
- **Project Number**
- **People on site**
- **Purpose of Work**
- **Weather Conditions**

Errors are single line crossed out and initialed

Blank Space crossed out and initialed

Bottom of each page signed and dated

GEI Consultants

STANDARD OPERATING PROCEDURE

FD-002 Field Observation Report

1. Objective

A Daily Report may be required to accurately summarize the activities, observations, and decisions made during the day's field work. The daily field observation report may serve as a permanent record of the day's activity for the Project Manager (PM), In-House Consultant (IHC), and National Grid.

2. Execution

- If required, at the close of the day's field work, a Daily Report must be prepared by the individual responsible for the field notebook. This report must be completed before leaving work for the day. Contents of the report should include, at a minimum, the following information.
    1. A record of person(s) present at the site, time of arrival, departure times (e.g., GEI, contractor(s), client, etc.).
    2. A record of the daily objective(s) and the activities performed (e.g., drilled five borings in the overburden).
    3. A summary of deviation(s) from the field plan or objectives.
    4. A summary of field decision(s) made, who made it/them, and the basis for such decision(s).
    5. A diagram, sketch, and/or map showing the location and extent of the work or other significant observation(s) made during the day.
    6. Any recommendations that may result from field observations and any actions that resulted from those recommendations.
    7. A summary listing and field sketch showing location(s) of field activity.
- Submit a draft report to the PM/IHC for review and editing related to the clarity and conciseness of the report. Complete any editorial changes, sign, date, and submit the report to PM/IHC for approval/signature. Field Observation Reports should be written neatly. They are not required to be typed unless specifically requested by the PM.

3. Notes

- Not all projects require daily field observation reports.
- The Field Observation Report should be based solely upon factual information, not opinions. Any speculation should be clearly noted in the report as such.

- The Field Observation Report should never be released to anyone other than the PM/IHC prior to review and signoff unless explicitly authorized by the PM/IHC.

4. References

New Jersey DEP Field Sampling Procedures Manual, August 2005.

Yerington Mine Site SOP-03 Standard Operating Procedure Field Notes and Documentation, Revision 0 Revision Date: June 6, 2006.

ASFE Model Daily Field Report (1991), ASFE, Inc.

5. Attachments

Attachment A – Example Daily Report Form

Attachment A

Attachment A: FIELD OBSERVATION REPORT

Project : **Date:**
Client : **Report No.**
Contractor: **Page:**
GEI Proj. No.

Time of Arrival: **Departure:** **Weather:**

Persons Contacted, Company **GEI Representatives**

Purpose of Site Visit:

Observations

1.

By:	**Reviewed By:**

GEI Consultants

STANDARD OPERATING PROCEDURE

FD-003 Sample Handling and Chain of Custody

1. Objective

To properly collect, label, document, preserve, package, and transport environmental samples; provide a record of the custody of any environmental field sample from time of collection to delivery to the laboratory. The chain of custody (COC) can be used as a legal document to demonstrate that samples were not mishandled and that they were delivered to the laboratory within the timeframe necessary to start analysis. A sample is under custody if it is in:

a) GEI's possession;
b) GEI's sight after being in GEI's possession;
c) it was in GEI's possession and then it was locked up to prevent tampering; or
d) a designated secure area. GEI facilities are designated secure areas.

2. Execution

- Review the work plan and Quality Assurance Project Plan (QAPP) prior to sampling to determine the following:
  i. The analysis required by the work plan and sample volumes required by the laboratory to perform those analysis. (Be explicit when requesting analysis on the COC (e.g. rather than "VOCs" [Volatile Organic Compounds], write "VOCs 8260".)
  ii. The turnaround time required by the project.
  iii. If the data will be sent directly from the laboratory to the data validator or Data Group.
  iv. Holding time restrictions for sampling media and analytical methods.
- Label the jar or bottle
- Following sample collection, the sample container is labeled using a waterproof marker with the sample ID, the date and time (military time) of sample collection, project number, sample preservatives, and the sampler's initials. Sample custody begins at this time.
- Record the above information in the field notebook.
- Individually wrap sample jars with packing material. Place samples in a chilled (4°C) cooler immediately after collection.
- Complete a COC for the samples as described below, and sign off on the COC each time a new person takes possession of the samples. A COC form must accompany each shipment/delivery of samples to the laboratory. GEI or laboratory COC forms may be used as long as the laboratory form contains the same required information as described below.

- An example COC is provided in Attachment A.
- Place a custody seal on the cooler if shipping.
- Transport samples to the laboratory as soon as possible. It is preferable the samples are sent from the field rather than brought back to the office for submission at a later date.

2.1. Chain of Custody (COC) Completion

- Record the project name and number, the sampler's name(s) and the site, town, and state where the samples were collected.
- For each sample, enter the sample identification number, date and time (military time) collected, whether the sample is a grab or composite sample and the number of sample containers. Record the type of analysis (including laboratory method; e.g. EPA-SW846 Method XX) requested and the preservative (if appropriate) in the vertical boxes.
- When samples are ready to be relinquished, complete the bottom of the form with date and time (military time) and signatures of relinquisher and receiver of samples as indicated. The sample collector is always the first signature while the analytical laboratory is the final signature. Theoretically, all individuals handling the samples between collection and laboratory should sign the form; however, if a common carrier (i.e., FedEx, UPS) is used for shipping, GEI must identify the carrier in the 'Received by' box on the COC. If the sampler hand delivers the samples to the laboratory, the received box must be signed by the laboratory.
- Include turnaround time and project contact on the COC.
- The forms are in triplicate (white, yellow, and pink copies). The pink copy should be retained by the sampling personnel and provided to the Data Group for proper filing. The white and yellow copies should accompany the samples to the laboratory.
- Prior to sample shipment, the COC must be placed inside the cooler (in a ziplock bag or other watertight package taped inside the lid of the cooler), and the cooler must be sealed with a signed COC seal.
- If a common carrier such as FedEx is used to transport the samples to the laboratory, include the carrier tracking number and identify the carrier in the "Received by" box on the COC.
- Any unused sampling containers/media that is sent back to the lab should be included on the COC. Return samples to the laboratory in a timely manner.
- Field duplicates should be anonymous to the laboratory, but must be recorded for use by the Data Group. To keep track of this information, link the field duplicate with the proper sample in the field copy of the COC and also the field book.

- Prior to samples being sent to the laboratory, the project or task manager will check the COCs for accuracy against the sample tracking summary, if appropriate, or the work plan.
- After the samples are sent to the laboratory, the field copy must be sent to the Data Group. You can send the field copy with duplicate information in the mail to the Data Group.

3. Notes

- The field notebook must document all GEI personnel who had custody of any samples prior to shipping the samples to the laboratory, the samples must be relinquished to the shipper and the COC signed and dated by the sampler and the shipper, even if both people are GEI personnel.
- Keep the number of people involved in collecting and handling samples and data to a minimum.
- Only allow people associated with the project to handle samples and data.
- Always document the transfer of samples and data from one person to another on chain of custody forms.
- Always accompany samples and data with their chain of custody forms.
- Give sample identification at all times that is legible and written with permanent ink.
- When sending samples via a common carrier, use one COC per package.
- Do not send samples from more than one site with separate COCs in a single package.

4. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory

Determination of Volatile Organic Compounds, Version 2.0 February 28, 2006.

5. Attachments

Attachment A – Example Chain of Custody

Attachment A

Chain of Custody Record

Example COC

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: GEI	Project Manager: Dave Terry	Date: 12-31-07	Chain of Custody Number: 00452
Address: 455 Winding Brook Dr	Telephone Number (Area Code)/Fax Number: 860 368 5300 / 860 368 5307	Lab Number:	Page 1 of 1
City: Glastonbury / State: CT / Zip Code: 06033	Site Contact: M. Felter	Lab Contact: Paul Mobart	
Project Name and Location (State): Carroll Gardens NY	Carrier/Waybill Number: FedEx 9383 7603 0879		
Contract/Purchase Order/Quote No.			

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		Analysis: VOC 8260B	SVOC 8270C	TO-15 + NAPHTHALENE
CGSB-01 (0-2)	12-31-07	1130				X		X							X	X	
CGSB-02 (3-4)	12-31-07	1250				X		X							X	X	
CGSB-02 (3-4) MS	12-31-07	1250				X		X							X	X	
CGSB-02 (3-4) MSD	12-31-07	1250				X		X							X	X	
CGSB-XX (5-6)	12-31-07	0800				X		X							X	X	
CGTB-123107	12-31-07	1400					TB				X				X		
CGGW-01	12-31-07	1430	X							X	X				X	X	
CGSG-01	12-31-07	0700-1500	X														X

Special Instructions/ Conditions of Receipt

CANISTER# 2613
REGULATOR# 779

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 see Contract

QC Requirements (Specify): ~~NEW JERSEY~~ NYS Cat B ASP deliverable send to Lorie Mackinnon

Send EDD to datagroup@geiconsultants.com

NEW JERSEY: "CLP data package deliverables"

	Date	Time
1. Relinquished By: Melissa J Felter	12-31-07	1600
2. Relinquished By:		
3. Relinquished By:		

	Date	Time
1. Received By: FedEx	12-31-07	
2. Received By:		
3. Received By:		

Comments
USED FLOW CONTROLLER FOR AIR SAMPLE INCLUDED

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

STANDARD OPERATING PROCEDURE

FD-004 Photo Documentation

1. Objective

To properly document and retain photographic records. Keeping a record of photographs taken is crucial to their validity as a representation of an existing situation.

2. Execution

- Photographs of a site, individual samples, or other observations should be taken using a digital camera.
- All photographic records should be recorded in the Field Notebook (SOP FD 001) and the following information should be recorded in the field notebook:
    i. Number of photograph in sequence.
    ii. Compass direction describing the direction the photograph was taken (e.g. looking southeast).
    iii. Brief description of what the photograph is intended to show.
- The field notebook should also note who took the photographs, and the date and time each photograph was taken.
- The photographs should be electronically backed up on a computer or other data storage device.
- Photographs should be placed on a photograph record template and the relevant information describing the photograph should be inserted into the caption section for each photograph.

3. References

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

4. Attachments

Attachment A – Example of Photo Documentation Template

Attachment A

Attachment A – Example of Photographic Record
GEI Consultants, Inc.

Project: Project Name

Location: Project Location

Photographer: K. Barber
Date: 10/25/07
Photo No.: 1
Direction: N

Comments:
Entrance of site with tree mulching operations.

Photographer: K.Barber
Date: 10/25/07
Photo No.: 2
Direction: W

Comments:
On-site building built in 1936.

STANDARD OPERATING PROCEDURE

FD-005 Surveying and Mapping Specifications

1. Objective

The objective of this Standard Operating Procedure (SOP) is to present the minimum requirements for establishing horizontal and vertical surveying control for field programs. Accurately surveyed locations are a key element in the evaluation of all field data, and are necessary for the preparation of geologic profiles and the interpretation of horizontal and vertical groundwater flow directions, and the locations of facilities. The accuracy of measurements and established elevations is particularly important when groundwater gradients are low, as errors may easily lead to misinterpretation of the direction of groundwater flow. The survey is usually performed after the field activities have been completed. Activities and land features requiring accurate horizontal and vertical control include:

- borings;
- test pits and trenches;
- monitoring wells and piezometers;
- geophysical surveys;
- surface water and drainage features;
- buildings and structures; and
- underground utilities and storage tanks as marked on the surface.

2. Execution

Mapping shall be based on field measurements and calculated to sufficient accuracy to be in conformance with A-2 standards, regardless of the intended end product of such work.

Standard site plans, as a minimum, shall provide the following elements:

- Location of all surface features, including, but not limited to: buildings, structures, fences, aboveground utilities, drainage equipment, underground features as marked on the surface, limits of pavement, landscaped or graded areas, and a general description of surface material and vegetation. All monitoring wells, soil borings, test pits, and other samples points shall be located.
- Location of all enclosed or abutting water bodies. Flow direction of rivers, streams, or surface drainage shall be noted with arrows.
- Location of boundaries by reference to other plans, when available, and to lines of occupation, where apparent. If this information does not exist, the surveyor shall make reference to Assessor's map and lot numbers.

- Disclaimers of certification to boundary and title should be prominently displayed.
- Location of surface features on abutting properties to a distance of 100 feet beyond property boundaries of study area are desired where practical, but in any case, to a minimum of 20 feet. Names of abutting property owners, as listed by the Town Assessor, shall be included.
- Include a location map of sufficient scale and detail to locate the site from a statewide reference.
- Provide a verbal and graphical scale of distance. All maps shall include a north arrow with reference to direction (magnetic, true, or grid). Unless a site-specific grid system is required, NAD83 (2007) should be identified as the horizontal datum.
- All maps shall be accompanied by copies of all field notes and sketches used in their preparation. The surveyor shall provide a coordinate and elevation list for all control and location points.
- Topography, when requested, shall conform to Class T-2 standards (90 percent of contours true to within 1/2 contour interval). The vertical datum should be identified on the plan. Monitoring well elevations shall be established at the ground surface and at the top of casing or riser.
- Requirements for location by state plane coordinates will include reference to geodetic monuments or global positioning system (GPS) base stations used.
- Plan should comply with GEI's Section 3 "File Specifications for Subcontractors" provided below.

Requests for boundary survey entail the following additional requirements.

- Examination of record descriptions of the property and adjoining parcels, of record surveys and plans, and of record easements appurtenant to the property. Record search will extend long enough to determine the original intended boundary locations. Certification as to ownership should be provided by the client's legal counsel.
- Location and description of all boundary monumentation found.
- Location of record easements and visible evidence of entry.
- Location and description of apparent encroachments by structures, occupation, and improvements on the property.
- Location and description of any conflict between deed description and actual occupation.
- Distance and bearing of property lines are to be shown to the nearest hundredth foot (0.01') and arc second (0°00'01"). Area should be shown in decimal acres and/or square feet.

- Plans should include certification as to conformation to state standards for boundary and topographic survey. No other certifications should be provided, except as specifically negotiated with the client.

2.1. Survey Requirements for Exploration Programs

The project manager shall go over the survey program with the survey chief to be sure that all requirements are understood and that the survey crew is alerted to potential site hazards.

The following criteria should be met for all survey programs.

- The survey is to be performed by or under the direction of a registered professional land surveyor.
- The survey shall be accurately performed to a precision of 0.01 foot for vertical control and 0.1 foot for horizontal control.
- Horizontal control is to be related to either a state plane coordinate system or the Universal Transverse Mercator (UTM) coordinate system. North American Vertical Datum (NAVD) 1988 should be used as the vertical datum unless a site-specific datum is required.
- Elevation precision to be obtained at monitoring wells and piezometers shall be:
    i. Top lip of protective casing without cover (0.01 foot); this point should only be used for vertical control and not for water-level measurements.
    ii. Top of monitoring well riser pipe (0.01 foot); a permanent reference point should be marked on the top of the riser to be used as the measuring point for all water-level measurements.
- Establish a permanent site benchmark on the most stable nearby feature and note its location on survey maps.
- The surveyor should submit a report of the survey, including a copy of all original field notes. Survey information needs to be reviewed carefully with respect to horizontal and vertical determinations. Survey errors may often be caught by using relative distances between wells or noting apparent anomalies in water levels or flow directions.

2.1.1. Previous Use of a Datum Other Than Mean Sea Level

Many times a parcel of land contains a previously established vertical benchmark on site to which elevations have been referenced. Such an arbitrary local datum may not provide any specific information about its relationship to Mean Seal Level (MSL), or a standard vertical datum. An arbitrary datum, when used, should be identified as a local or arbitrary datum. In other cases, when a standard city-wide local datum is used, the vertical relationship to the standard datum should be provided.

Otherwise, surveys at all sites subject to agency review shall be referenced to NAVD88.

2.1.2. Weather Conditions

Inclement conditions increase the chance for errors in identification, measurement, and recordings. Surveyors need to take extra time to assure proper identification of all monitoring wells surveyed, to guarantee ice- and snow-free surface elevation shots, and to carefully record survey data despite adverse conditions. Obtaining stable tripod set-ups may be more difficult under these conditions. Sightings should use shorter distances than under more favorable conditions. Warm, sunny days generate heat waves that may present problems for optical instruments.

2.1.3. Work at Hazardous Waste Sites

Surveyors need to be made aware of hazardous site conditions and potential exposures. Surveyors should have been enrolled in a health monitoring program for any sites which require personal protection above Level D. Note that anticipated risks to surveyors would be expected to be less than for those engaged in collecting samples or in subsurface explorations. However, potential exposure to hazardous materials should be pointed out and appropriate protective equipment worn and used. Surveyors shall also be made aware of other site activities and procedures for evacuation in case of emergency.

3. File Specifications For Subcontractors

3.1. General File Standards

- The method of naming files shall incorporate the name of the site and/or the GEI project number and the content. For example, SITE NAME-001110-Site Layout.
- All files provided to GEI will be electronically transmitted or recorded on CD, DVD, or other permanent recording medium. All referenced files and other supporting files such as special line types, color tables, images, etc., shall be included.
- All files are to be provided in .DWG or .DXF format and shall be compatible with AutoCAD Release 2007.
- It will be standard procedure to have purged all unused entities from a CAD file prior to delivery.
- Each file will be clearly labeled as follows:
    i. Project No.:
    ii. Project Name:
    iii. Drawing Title:
    iv. File Size:
    v. Date:

vi. Revised Date:

- Files which contain non-standard ACAD fonts, line types or custom menus are not acceptable.

3.2. General Drafting Standards

- All entity line types, colors, etc. are to be defined “BYLAYER.”
- It shall be standard to use “object snap” for the creation or insertion of all entities (as compared to “eyeballing”).
- All symbols will be originally drawn on layer “0.” This will allow the symbol to acquire the color and line type properties it is inserted on. All symbols used to define sample locations are to contain attributes describing the sample identifier and any elevation data required by contract.
- All line entities are to be continuous polylines (PLINES).
- All text shall be rotated such that it is readable from the bottom of the sheet and from the right of the sheet. It will be standard to use the AutoCAD style “STANDARD” and Arial font whenever possible. All text shall be of a size such that it is legible when plotted at the file's intended scale.
- North up or to the right.

3.3. General Layering Standards

- The following are some of the acceptable layer names. Others may be added as needed. Descriptions of new layers are to be provided to GEI.
  i. PROPERTY (property lines)
  ii. TRAVERSE
  iii. BASELINE
  iv. BUILDING (buildings, other on-site/off-site structures)
  v. STREET
  vi. ELEC (all electrical lines, manholes, power poles, transformers)
  vii. WATER (all water lines, manholes, hand holes, gates, valves)
  viii. SAN (all sanitary sewer lines, manholes, catch basins, if combined sanitary/storm sewer)
  ix. STM (all storm sewer lines, manholes, roof drains, catch basins)
  x. CONTOUR (all contour lines & labels)
  xi. TEL (telephone)
  xii. GAS (all gas lines, valves, etc.)
  xiii. TEXT
  xiv. TANKRIVER
  xv. STREAM
  xvi. SEDIMENT (sediment sample location)
  xvii. SURFACE SOIL (surface soil sample location)
  xviii. MW (monitoring well location)

xix. BORING (soil boring location)
xx. SURFACE WATER (surface water sample location)
xxi. PAD, SLAB, STRUCTURE, FND (foundations or miscellaneous structures)
xxii. EASEMENT
xxiii. SAMPLING LAYERS (begin with “E” existing or “P” proposed)

3.4. Additional Data Required

- All files shall be accompanied by a “check plot” of each file. The “check plot” shall be checked for accuracy and corrected as necessary.
- Whenever surveyed files are supplied to GEI, they shall be considered incomplete until GEI is provided with copies of all field notes and sketches, data printouts, and a point reference file (if applicableI).

STANDARD OPERATING PROCEDURE

FD-006 Handheld Global Positioning Receiver Operation

1. Objective

Use handheld global positioning system (GPS) receivers to locate sample points and site features with "Mapping-Grade" accuracy.

Use handheld GPS receivers to "stake out" proposed sample point locations within the limits of "Mapping Grade" accuracy.

2. Execution

- Handheld GPS receivers provide a low-cost and user-friendly method for locating sample points and site features with a fair degree of horizontal accuracy.
- In simplistic terms, GPS works by measuring the distance from numerous orbiting satellites to a point on the earth surface. Individual satellites broadcast their real-time location in terms of x, y and z coordinates, and the distance from each satellite is measured as a function of the length of time that a time-stamped signal takes to reach the receiver. Built-in GPS software derives new points by intersecting the distances from known orbital locations – in much the same way that points are located by intersecting tape-measured distances from building corners or other pre-existing site features.
- Late-model handheld GPS receivers utilize a real-time differential correction technique called WAAS (Wide Area Augmentation System). This system was designed to provide greater confidence and reliability in using GPS data for commercial aircraft landing approaches, and the additional correction improves all GPS operations.
- Handheld GPS receivers display navigational information on a variety of standard pages. Although each manufacturer uses slightly different formats, all receivers toggle back and forth between the following visual presentations:
    i. A "satellite" page displays the relative orbital location of all GPS satellites that are currently being tracked by the receiver. The display may include information on the real-time geometrical strength of the solution: satellite intercepts that cross at right angles provide more accurate solutions than intercepts that cross at acute or obtuse angles.
    ii. A "track" page that displays the travel path of the receiver while it is turned on, along with the relative location of recorded points. Many GPS models have a "track-back" function that will guide the user on the same path back to the starting point.

iii. A “navigation” page that displays instantaneous location and the real-time direction and velocity of travel. Some units provide two pages to display this information in different formats. Most units will report the overall “course made good” (straight-line bearing and distance from the starting point) at any point.

iv. A “waypoint” page that allows users to “Go To” a created point or previously recorded point by providing a straight-line bearing and distance to the point. The information is instantaneously updated as the user moves along; some units display a pointing arrow that directs the user to the direction of travel. Be careful of go-to lines that lead through swamps or over cliffs – if you will be travelling in difficult terrain have a paper copy of the USGS quadrangle and a compass on hand for navigation.

- Signal strength degrades significantly next to buildings and underneath tree canopy. Most GPS receivers have an “averaging” function to improve the accuracy of shielded locations. GPS users can also improve precision by locating points three times, at different times of the day. Two of the solutions will generally be closer to each other than to the third and can be averaged for a more reliable fix.
- Most GPS receivers default to latitude and longitude, but data is more accurate and easier to input and when expressed in Universal Transverse Mercator (UTM) coordinates to the nearest meter. The handheld GPS setup will have a function somewhere to change to UTM. All of Long Island is in UTM Zone 18.
- Consult “Corpscon” the datum translator available from the National Geodetic Survey website. Corpscon translates instantly from latitude/longitude to UTM coordinates to state plane coordinates and provides tools to identify UTM Zones. Also consult the Trimble, Garmin and Magellan websites for technological improvements and discussion of advanced techniques.

3. Notes

- Handheld GPS receivers operating in unobstructed locations are currently reckoned to provide 2-5 meter accuracy, meaning that the true location of measured points lie within an “error ellipse” with axes of 2-5 meters centered on the measured location. In other words, even under the best of conditions a real-time GPS solution may be as much as 20 feet off the true horizontal location of a point.
- Due to geodetic restrictions, vertical locations (elevations) have less than half the accuracy of horizontal locations, meaning that even under the best of conditions, a surface elevation displayed on a handheld GPS receiver may be off by more than 50 feet.
- Horizontal and vertical data derived from handheld GPS receivers should never be considered more than relatively accurate, and this

level of uncertainty should be identified in any discussion of positional tolerance.

4. References

Trimble Website: www.trimble.com
Garmin Website: www.garmin.com
Magellan Website: www.magellangps.com
National Geodetic Survey: http://www.ngs.noaa.gov/

Section 4

DRILLING METHODS (DM)

SUMMARY GUIDANCE

DM-001 General Guidance on Determination of Appropriate Drilling Methods

1. Objective

There are multiple drilling methods which can be employed based on the type of stratum (e.g. overburden or bedrock) and the end use of borehole. End uses include geotechnical investigation, subsurface soil sampling, and monitoring well installation or a combination thereof.

The following text describes different methods of drilling with considerations for their use to collect groundwater and/or subsurface soil samples. Profiles of subsurface conditions encountered and well installation details must be recorded on logs. Procedures for field documentation are provided in Section 3 – Field Documentation.

2. Hollow-Stem Augers (HSAs)

Borings can be installed in unconsolidated formations using hollow-stem augers (HSAs). The augers are advanced by rotation and the drill cuttings are brought to the surface by travelling up the outside of the auger flights in a screw-like manner. HSAs have the advantage of allowing the well to be installed inside the hollow stem of the auger, which prevents the borehole from collapsing. Upon reaching the planned well depth, the casing and screen are placed inside the HSAs and the flights are individually removed while the annular space around the well is filled with the filter pack and grout, as appropriate. Conversely, solid-stem augers must be completely removed from the borehole before well installation, which can lead to collapse of the borehole. For this reason, solid stem augers are seldom used for installation of monitor wells.

HSAs come in a variety of sizes and allow collection of soil samples utilizing split spoons or Shelby tubes. Samples are collected ahead of the augers for determining soil/sediment type, stratigraphy, depth to the water table, and for collecting soil samples for chemical analysis. During this process, the standard penetration test (SPT, American Society for Testing and Materials [ASTM] Method D 1586) can also be performed. The HSA method also has an advantage over mud-rotary drilling techniques in that drilling mud is not used that can contaminate the soil samples and potentially reduce the yield of the wells.

A disadvantage of the method is that HSAs cannot be used to drill into competent bedrock or through large boulders. Also, "heaving or running sands" can be forced up inside the augers as a result of strong vertical groundwater gradients, which can hamper efforts to collect soil samples or complete well installation. Furthermore, the maximum depth achievable using HSAs, which is generally shallower than other methods, is dependent not only on the ability of the rig (e.g.,

horsepower, rig-torque, weight of augers, etc.), but also the lithology of the material drilled.

3. Rotary Drilling

Rotary drilling methods include both direct rotary and reverse-circulation rotary. Direct rotary is more commonly used in environmental investigations, whereas reverse-circulation rotary is used in drilling large-diameter water supply wells. In direct rotary drilling the borehole is advanced by rotating the drill pipe (rods) and bit to produce a cutting action. The cuttings are removed from the borehole by continuous circulation of a drilling fluid. The fluid or "mud" is pumped down the inside of the drill pipe and is circulated back to the surface on the outside of the pipe. The fluid removes the drill cuttings from the borehole and cools and lubricates the bit. Mud used during direct rotary consists of additives (e.g., bentonite), water, or air.

Reverse-circulation rotary drilling is similar to direct rotary except the drill rigs are larger and the flow of the drilling fluid is reversed. The drilling fluid moves upward inside the drill pipes and circulates back to the borehole via settling pits. The drilling fluid returns to the borehole via gravity and moves downward in the annular space between the drill pipe and borehole wall. Drilling fluids for reverse-circulation rotary are generally water and any suspended particles picked up from the surrounding formations.

Mud-rotary methods can be used to drill in both unconsolidated and consolidated (bedrock) formations. In addition, drilling mud stabilizes the borehole and limits the potential for borehole collapse. Disadvantages of using the mud-rotary method include the difficulty in determining the depth to the water table, the potential for drilling mud to impact soil samples and dragging of contamination into deeper zones since the drill cuttings are re-circulated in the borehole. Wells installed using this method typically take longer to develop than wells installed using the HSA or air-rotary methods due to the invasion of mud filtrate into the formation.

In air-rotary drilling, compressed air is directed down the inside of the drill pipe to a percussion “hammer” that breaks up soil and shatters rock. As in mud-rotary drilling, air removes the cuttings and lubricates the bit. However, since air has no viscosity, it cannot be used to stabilize a borehole therefore, casing must be advanced in unconsolidated formations to keep the borehole open. This is why air rotary methods are best suited for drilling in bedrock formations. The percussion-type air-rotary "hammer" bit provides the best penetration rate when drilling bedrock consisting of crystalline rock. However, when drilling above the water table, an air-rotary bit can grind the soil and bedrock to a fine powder which is blown out of the hole with air and which has the potential to be inhaled. Therefore, drilling above the water table using air-rotary methods requires the addition of potable water to the borehole for dust control. In addition, the air

compressor should be of the oil-less variety, or have a filter to prevent any oil from entering the borehole.

A disadvantage of using rotary methods while drilling in unconsolidated formations is the requirement of pulling the drill pipe out of the hole each time a split-spoon soil sample is collected (and the SPT is performed). This adds up to considerable amounts of time when deep wells are being installed or when continuous split-spoon sampling is being performed. As stated above, split-spoons used to collect soil samples can become contaminated when they are advanced down a mud-filled borehole.

A special type of rotary drilling is bedrock coring, wherein a special core bit and barrel are used to retrieve relatively undisturbed core samples of the bedrock. Coring allows better characterization of bedrock lithology and other features including orientation of fractures and bedding planes, which can control contaminant migration. Core barrels can either be unoriented or oriented. An oriented core is scribed with respect to magnetic north. Although more expensive than collecting an unoriented core, this method gives the true orientation of the features encountered in the core.

Drilling fluids are generally air (air-rotary) or bentonite and/or water (mud-rotary). Water added to a borehole must be of potable quality. The source of the potable water used during the installation (and development) of monitor wells should be documented (e.g., in the Remedial Investigation Report).

Bentonite is high swelling clay with sodium montmorillonite as its primary clay mineral. Bentonite is added to water to increase the viscosity of the drilling fluid so that drill cuttings can be removed from the borehole more effectively. At the same time, the viscosity must be low enough to allow cuttings and coarse-grained particles to settle out once they are circulated out of the hole. Bentonite also adds weight to the drilling fluid, which helps to maintain borehole stability.

4. Sonic Drilling

The method involves driving a core barrel using vibration, rotation, and a downward force to collect soil samples. A sonic drill rig looks and operates very much like a conventional top-drive rotary or auger rig. The main difference is that a sonic drill rig has a specially designed, hydraulically powered drill head or oscillator, which generates adjustable high-frequency vibrational forces. The oscillator uses two eccentric, counter-rotating balance weights or rollers that are timed to direct 100 percent of the vibrational energy at 0 and 180 degrees. There is an air spring system in the drill head that insulates or separates the vibration from the drill rig itself. The sonic head is attached directly to the drill pipe or outer casing, sending the high-frequency vibrations down through the drill pipe to the bit.

A core barrel is advanced using vibration, rotation, and downward force to collect continuous soil cores up to 20 feet in length. The bit at the end of the core barrel contains carbide teeth allowing the core barrel to be advanced through most overburden, soft bedrock, and minor obstructions such as bricks and boulders. Once the core barrel has been advanced, a secondary or "over-ride" casing is advanced down to the same depth as the inner core barrel. The over-ride casing keeps the borehole from collapsing while the inner core barrel is removed. Once the core barrel is removed, the soil core is pushed out of the core barrel through the use of vibration and either air or water pressure. Soil core diameters are dependent on the size of core barrel used and range from 3 to 12 inches. The use of multiple over-ride casings of increasing diameter allows the borehole to be telescoped down through multiple confining units. The setup used in sonic drilling makes this drilling method amendable to collecting soil cores and installing wells in angled boreholes. With only the bottom of the inner and outer core barrel exposed to the aquifer at any given time, determining the location of the water table can be difficult.

While this drilling method has the capability of drilling through and providing samples of coarse gravels, boulders, and tight clays, these situations will result in slow drilling or advancement of the core barrel. The result is a hotter core barrel and a longer contact time between the core barrel and the encased soil core. The aforementioned conditions will increase the probability that the sonic method will raise the temperature of the soil core and facilitate volatile organic compound (VOC) and semi-volatile organic compound (SVOC) loss.

The ability to quickly install deep borings and wells, while generating a large-diameter continuous soil core, makes this drilling technique invaluable when continuous soil sampling is needed to assess deep or complex geological situations. However, sonic drilling's high cost, relative to other drilling methods, may be prohibitive for small projects or shallow boreholes. The higher cost of the drilling method should be weighed against the cost savings incurred due to its faster drilling rate and high quality of the soil core produced.

5. GeoProbe®-Direct Push

The method involves hydraulically pushing a sampling device attached to a string of hollow rods into the subsurface for the purpose of collecting soil and/or groundwater samples (e.g., Geoprobe®). The method can be used to collect discrete soil samples or groundwater samples, as well as install small-diameter groundwater monitoring wells.
Advantages of the direct-push method include the relatively quick collection of groundwater samples and, when used along with a mobile laboratory, collection of data in “real” time. The method allows for collection of multiple samples in a day with the potential for achieving contaminant delineation in one mobilization of the field equipment. The data can also be used to select locations of permanent monitor wells.

Disadvantages of using a mobile lab include the fact that the data quality achieved are often suitable only for screening purposes. Direct-push methods typically result in very turbid groundwater samples since an oversize borehole is not produced and a filter pack is not used. Turbid samples can produce higher metal concentrations in groundwater samples since metals are typically adsorbed onto soil particles. Use of direct-push methods can also cause cross-contamination since contamination from shallow zones may be driven down to deeper zones.

Another disadvantage of using direct-push technology for collecting groundwater samples is the potential to breech confining units. To prevent this, soil sampling using direct-push technology or conventional split-spoon sampling techniques should first be performed to identify the presence, depth and lateral extent of confining units. Pushing through confining units should be avoided if the presence of dense non-aqueous phase liquid (DNAPL) or very soluble compounds, such as methyl tert-butyl ether (MTBE), are suspected or the contaminant plume appears to be diving in the aquifer.

STANDARD OPERATING PROCEDURE

DM-002 Hollow-Stem Auger

1. Objective

To standardize the drilling of overburden soil borings for environmental investigations. This standard operating procedure (SOP) addresses the use of hollow-stem augers to drill the soil boring.

2. Execution

- If work is to be conducted on private property, verify that National Grid has been notified (see SOP PP-001) and that National Grid has verified that access has been granted.
- Ensure that markout procedures outlined in PP-001, PP-002, and PP-003 have been completed.
- Ensure that a safety check has been conducted.
- Inspect the drilling rig to make sure it has been appropriately decontaminated and that the down-hole equipment has been steam-cleaned. Check that the steam-cleaner is working properly (i.e., that steam is being produced). Record all observations and measurements in the field notebook.
- Plastic sheet, plywood sheet, or other suitable cover will be placed around the auger area during drilling, if needed, to contain soil cuttings.
- Soil cuttings will be placed in a 55-gallon steel drum or a roll-off container for subsequent sampling and disposal. Decontamination water and drilling water will be placed in tanks and/or 55-gallon steel drums for proper disposal.
- Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface.
- For all split-spoon soil samples, use a 140-pound hammer to drive the sampler, unless conditions necessitate using a 300-pound hammer (see SOPs SM-001, *Split-Spoon Sampling* and SM-0003, *Soil Classification,* for details). Count and record the number of blow counts per 6-inch increments, confirming, blow counts with driller if necessary.
- Remove the sample with a clean laboratory spoon and transfer it directly to a suitable sample container.
- Label, preserve, and store the sample in accordance with SOP SC-002 *Sample Handling*.
- Decontaminate the split-spoon sampler after each use (see *Equipment Decontamination,* SOP QA-001) or use another decontaminated split-spoon sampler.

- Direct the drillers to drill the borehole to the top of the next sampling interval. Remove the auger cutting bit/plug and insert the split-spoon sampler into the interior of the augers (the drillers are responsible for this activity). Measure the stick-up of the rods attached to the sampler to ensure that the nose of the spoon is in virgin soil below the augers.
- Watch for signs of a soil strata change at depth during drilling (i.e., change in blow counts, change in soil color, soil wetness, soil contamination, bouncing of the drill rig, etc.). If important to the investigation, stop drilling and collect a soil sample.
- Repeat until the borehole has been drilled to the desired depth.
- If a monitoring well is not installed in the soil boring, the boring should be abandoned with cement/bentonite grout. Do not backfill the boring with drill cuttings unless explicitly allowed under state-specific regulations and approved by National Grid.
- Complete boring log and, if necessary, well installation logs (SOP SM-003, *Soil Classification*).
- Record boring locations on a site map and in a field notebook sketch. Measure each location from onsite reference points in the field notebook so that enough information can be obtained to recreate the location.
- All boring locations or monitoring well locations should be surveyed and a boring/well location figure generated.

3. Notes

- In areas of significant soil contamination, hollow-stem augers may cross-contaminate upper soil layers as contaminated cuttings move up the auger flights. The potential also exists for contaminated augers to carry contamination to deeper soil strata.
- If *in situ* borehole permeability tests are to be performed prior to installation of the monitoring well, the hollow-stem auger method is not appropriate due to water loss at the auger junctions.
- If significant unanticipated contamination is encountered during drilling, stop drilling to confer with the project manager and evaluate health and safety conditions. If the borehole is to be advanced below the contaminated strata, use telescoping techniques, if appropriate, (see SOP DM-008 *Monitoring Well Telescoping*) to avoid cross-contaminating underlying geologic strata.
- When drilling below the groundwater table in fine to medium sands, the potential exists for the phenomenon of “running sands” or “blow in” to occur. Frequent measurements inside the hollow-stem augers after the drill bit/plug is removed will indicate if running sands are present.
- If necessary, arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site. Containers should be labeled.

- Plan the drilling program to drill borings from the least- to most-contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at each planned soil boring location. Alternative locations will need to have utility clearance.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

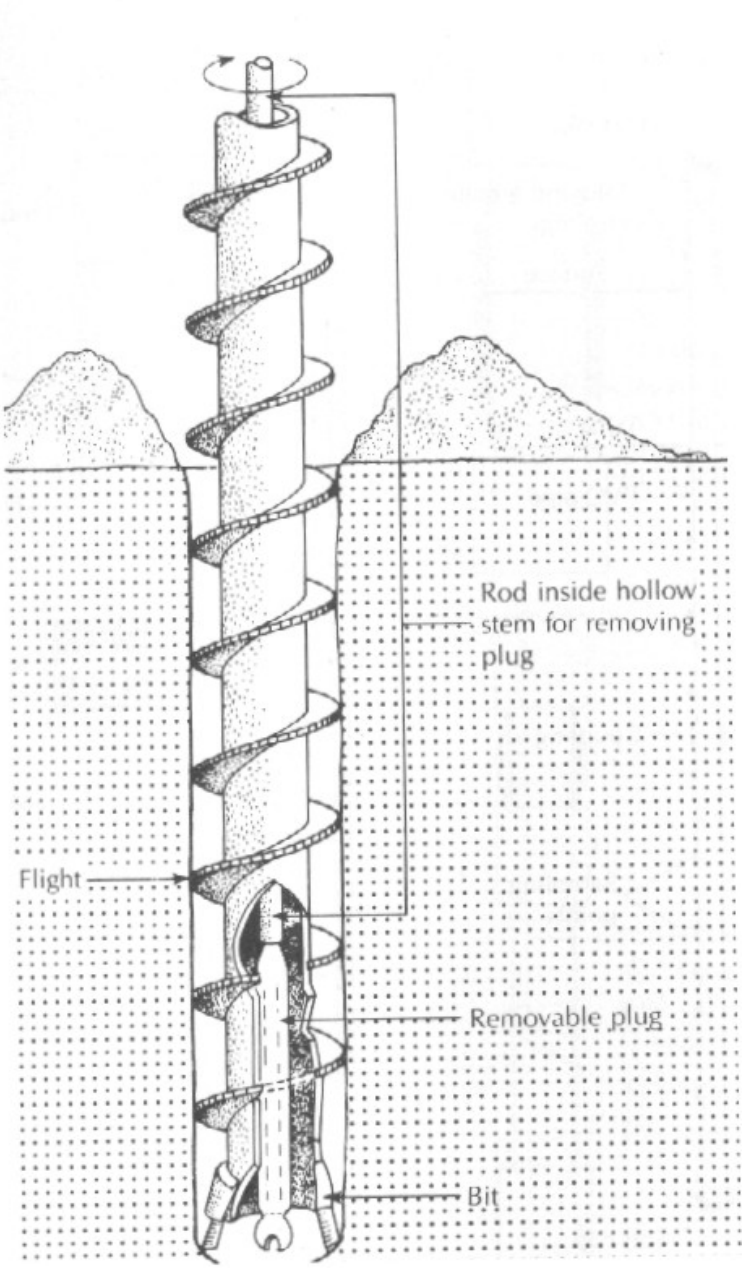
5. Attachments

Attachment A – Hollow-Stem Auger

Attachment A

SOP DM-002

Attachment A – Hollow Stem Auger



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STANDARD OPERATING PROCEDURE

DM-003 Sonic Drilling

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the drilling of overburden soil borings for environmental investigations. This SOP addresses the use of sonic drilling to drill the soil boring.

2. Execution

- If work is to be conducted on private property, verify that National Grid has been notified (see SOP PP-001) and that National Grid has
- verified that access has been granted.
- Ensure that markout procedures outlined in PP-001, PP-002, and PP-003 have been completed.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned. Check that the steam-cleaner is working properly (i.e., that steam is being produced). Record all observations and measurements in the field notebook.
- Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface (bgs).
- Collect soil cores in shorter runs. While some sonic rigs have the capability of collecting 20 feet of soil core at a time, the process of collecting the longer core results in the core being in contact with the core barrel for a longer period of time and consequently absorbing more heat from the core barrel itself.
- The core barrel should 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.
- The core barrel will then be advanced, within the isolation casing on the same borehole, to collect the next soil core interval.
- Add water between the inner core barrel and the outer override casing. This water would reduce friction and adsorb heat between the inner core barrel and the outer over-ride casing.
- Maximize drilling advance rate. The faster the core barrel is advanced, the less likely the core barrel will heat up, and the less contact time the soil core has with the core barrel. Drilling with a 3-inch diameter core barrel and a 5-inch diameter override casing, instead of the standard 4-inch core barrel and 6-inch over-ride casing, may increase advance rates and reduce the potential for soil core heating.

- If a significant decrease in drilling advance rate is observed, stop drilling and remove what soil core has accumulated in the core barrel. Resume drilling through the resistant material (gravel, boulder, hard clay, etc.). When the resistant material has been penetrated and the drilling advance rate increases, stop drilling and remove what material has accumulated in the core barrel.
- Wash down the core barrel with cool water to cool the core barrel and associated casing, and resume drilling.
- If a well is to be installed in the borehole, the sandpack and grout are placed as the core-barrel and over-ride casing(s) are selectively vibrated out of the ground. The vibratory action reportedly facilitates the settlement of the sandpack and grout. Upon completion, no casing is left in the ground other than the well casing and screen.

3. Notes

- Disturbance of the soil core is most likely to occur during removal of the soil core from the core barrel. The soil cores are usually vibrated out of the core barrel into plastic bags approximately 5 feet in length. As the plastic bags are a little larger than the soil core itself, fragmentation of the soil core may occur as the core is extruded into the bag or while the bagged core is being moved in an unsupported manner. Soil conditions that are prone to disturbance include wet or dry zones that contain little or no fines, and well graded sands that contain significant volumes of water.
- If integrity of the soil core is of concern, the following procedures should be implemented:
    i. Measures should be taken to ensure that the core, from the time it is extruded from the core barrel, is rigidly supported through the use of some type of cradle or carrying device.
    ii. The core should not be removed from its cradle until all sampling of the core has been completed. Acrylic liners are available for some core sizes and can be used to hold the core together upon removal from the core barrel.
    iii. If the soil is to be sampled for volatile organic compounds (VOCs), acrylic liners must be used.
    iv. Sampling of the soil core for VOCs or semi-volatile organic compounds (SVOCs) must be approved on a case by case basis. Proposals for VOC or SVOC soil core sampling must include provisions to minimize core fragmentation and heat generation, such as:
        1. Acetate liners in the core barrel so that the soil core does not have to be extruded out of the core barrel.
        2. Limit the length of soil core generated during a given downhole run.

3. Implement practices to reduce the residency time of the soil core in the core barrel.

- For the analysis of SVOCs, the use of the acetate liners is not required.
- The large diameter of the core barrel enables ground water sampling equipment to be placed inside the core barrel so that discrete depth groundwater samples can be collected during borehole advancement.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

STANDARD OPERATING PROCEDURE

DM-004 Drive and Wash

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the drilling of overburden soil borings for environmental investigations. This SOP addresses the use of casing with either the drive-and-wash or spin method to drill the soil boring.

2. Execution

- If work is to be conducted on private property, verify that National Grid has been notified (see SOP PP-001) and that National Grid has
- verified that access has been granted.
- Ensure that markout procedures outlined in PP-001, PP-002, and PP-003 have been completed.
- Steam cleaning may be performed by drillers either on site or prior to site mobilization. If performed prior to site mobilization, observe the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned. Check that the steam-cleaner is working properly (i.e., that steam is being produced). Record all observations and measurements in the field notebook (See SOP FD-001).
- If a surface-soil sample is desired, this sample should be collected prior to hand-clearing the borehole and in accordance with SOP SM-001 and American Society of Testing and Materials (ASTM) Specification D-1586-84.
- Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface.
- For all split-spoon soil samples, use a 140-pound hammer to drive the sampler, unless conditions necessitate using a 300-pound hammer (see SOPs SM-001, *Soil Sampling Techniques Including Split-Spoon* and SM-0003, *Soil Classification,* for details). Count and record the number of blow counts per 6-inch increments, confirming, blow counts with driller if necessary.
- Decontaminate the split-spoon sampler after each use (see SOP QA-001 *Equipment Decontamination).*
- Instruct drillers to drill the borehole, either by pounding or spinning the casing, to the top of the next sampling interval.
- The wash water should be carefully observed for indications of a soil strata change with depth (i.e., change in soil color and particle size). Record the changes and depth of changes on the boring log. Make sure that the soils in the borehole have been fully removed by the rotary bit before sampling by measuring the depth of the borehole, or

by measuring the length of stick-up of drill rods to verify that the driller has sufficiently cleaned out the boring.

- Monitor the return wash water and record water losses from around the borehole onto the ground surface.
- Follow steps until the borehole has been drilled to the desired depth. If refusal is encountered, a 5-foot core of the rock (at a minimum) may be required to confirm the bedrock surface (see site-specific field sampling plan).
- If a monitoring well is not installed in the soil boring, the boring should be abandoned with cement/bentonite grout. Do not backfill the boring with drill cuttings unless explicitly allowed under state-specific regulations and approved by National Grid.
- Complete boring log and, if necessary, well installation logs (see SOP SM-006 *Rock Coring Log*).
- Record boring locations on a site map. Measure each location from on-site reference points and record the information in the field book.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and & Safety Plan.
- When the first 5-foot section of casing is pounded into the ground, make sure that the casing (i.e., the borehole) is vertical.
- If significant unanticipated contamination is encountered during drilling, stop drilling to confer with the project manager and evaluate health and safety conditions.
- If the borehole is to be advanced below the contaminated strata, use telescoping techniques (see DM-008 *Monitoring Well Telescoping)* to avoid cross-contaminating underlying geologic strata.
- While drilling through contaminated strata, do not recirculate the drilling water. Be prepared to containerize the drilling water in these situations.
- When drilling below the groundwater table in fine to medium sands, the potential exists for the phenomenon of “running sands” to occur. To minimize the problem, remove the drill rods with the rotary bit very slowly while adding potable water to the casing. A head should be kept on the borehole at all times.
- Arrange for the storage of contaminated soil cuttings and water in drums or other appropriate containers in a secure place at the site (see SOP SC-003, *Investigation Derived Waste*).
- Plan the drilling program to drill borings from the least to most contaminated areas. Be prepared in advance and know where alternative drilling locations are in the event that problems are encountered at each planned soil boring location. These locations must also have been cleared by the state utility service prior to drilling.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

ASTM Standard D1586, Standard Method for Penetration Test and Split Barrel Sampling of Soils.

STANDARD OPERATING PROCEDURE

DM-005 GeoProbe® Direct Push Boring

1. Objective

The purpose of this standard operating procedure (SOP) is to standardize soil sample collection using GeoProbe® and MacroCore® technologies. A Geoprobe® relies on a relatively small amount of static (vehicle) weight combined with percussion as the energy for advancement of a tool string. Using a Geoprobe®, you can drive a MacroCore® to obtain continuous soil cores or discrete soil samples.

2. Execution

- Complete utility markout procedures in accordance with PP-001, PP-002, and PP-003.
- Inspect the drilling rig to make sure it is clean and that the down-hole equipment has been steam-cleaned. Check that the steam-cleaner is working properly (i.e., that steam is being produced). Record all observations and measurements in the field notebook.
- Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface.
- Insert a Macrocore® (MC) liner, (i.e., polyvinyl chloride [PVC]) into the sample tube, and connect a MC drive head to the top of the sample tube. A diagram of the MC assembly is provided as Attachment A.
- The drive head is then tightened into the sample tube, and a drive cap is attached to the drive head.
- Place the sampler in the driving position, and drive the sampler until the drive head reaches the ground surface.
- Remove the drive cap, attach a pull cap to the sampler drive head, and pull the sampler out of the ground.
- Remove the cutting shoe and filled liner.
- When the sampler is brought to the ground surface, it should be opened immediately, and the length of recovery should be measured and recorded.
- Decontaminate the sampler if necessary (SOP QA-001 *Equipment Decontamination*) and reassemble the parts with a new liner, and insert the sampler down the same hole to take the next soil core.
- In non-cohesive soils, slough material may enter the sampler as the next core is collected (see notes below).
- Careful logging of soil stratigraphy is necessary to document whether soil sloughing has occurred within the borehole (see limitations).
- Remove the sample with a clean laboratory spoon and transfer it directly to a suitable sample container.

- Label, preserve, and store the sample in accordance with SOP SC-002 *Sample Handling*.
- If a monitoring well is not installed in the soil boring, the boring should be abandoned with either cement/bentonite grout. Do not backfill the boring with drill cuttings unless explicitly allowed under state-specific regulations and approved by National Grid.
- Upon completion, all soil boring locations will be surveyed. This will include the location and ground surface elevation.

3. Notes

- The GEI oversight person shall ensure that the borehole created by the MC sampling tube does not collapse between collection of each sample. If the borehole collapses and representative samples cannot be obtained using the standard macro-core sampler, then one of two options may be used.
    i. The MC sampler can be fitted with a piston rod assembly, or a 1.5-inch outer diameter (OD), large bore sampler equipped with a piston rod assembly may be used to collect the samples. The sample tube (MC) is advanced through the caved-in borehole material to the top of the desired sampling interval. The sample tube remains closed by a piston tip as it is advanced. Upon reaching the target sample depth, the piston tip will be released and the discrete sampler device is then advanced to collect the representative sample.
    ii. The piston rod assembly is driven up to the top of the sample tube as the sample enters the tube.
- Because the MC sampling tube uses a dedicated, disposable liner made of clear plastic, the only part of the sampler that contacts the soil sample is the cutting shoe. Each sample liner will be disposed of after use and a new liner will be placed in the macro-core tube prior to collection of subsequent samples. Cutting shoes and sample collection spoons used to transfer samples to the laboratory jars will be decontaminated between use.

4. References

ASTM D6001-05 Guide for Direct Push Water Sampling for Geoenvironmental Investigations, April 2005.

GeoProbe Systems, "GeoProbe MacroCore MC-5 1.25-inch Light Weight Center Rod Soil Sample System SOP", Technical Bulletin No. MK 3139, November 2006.

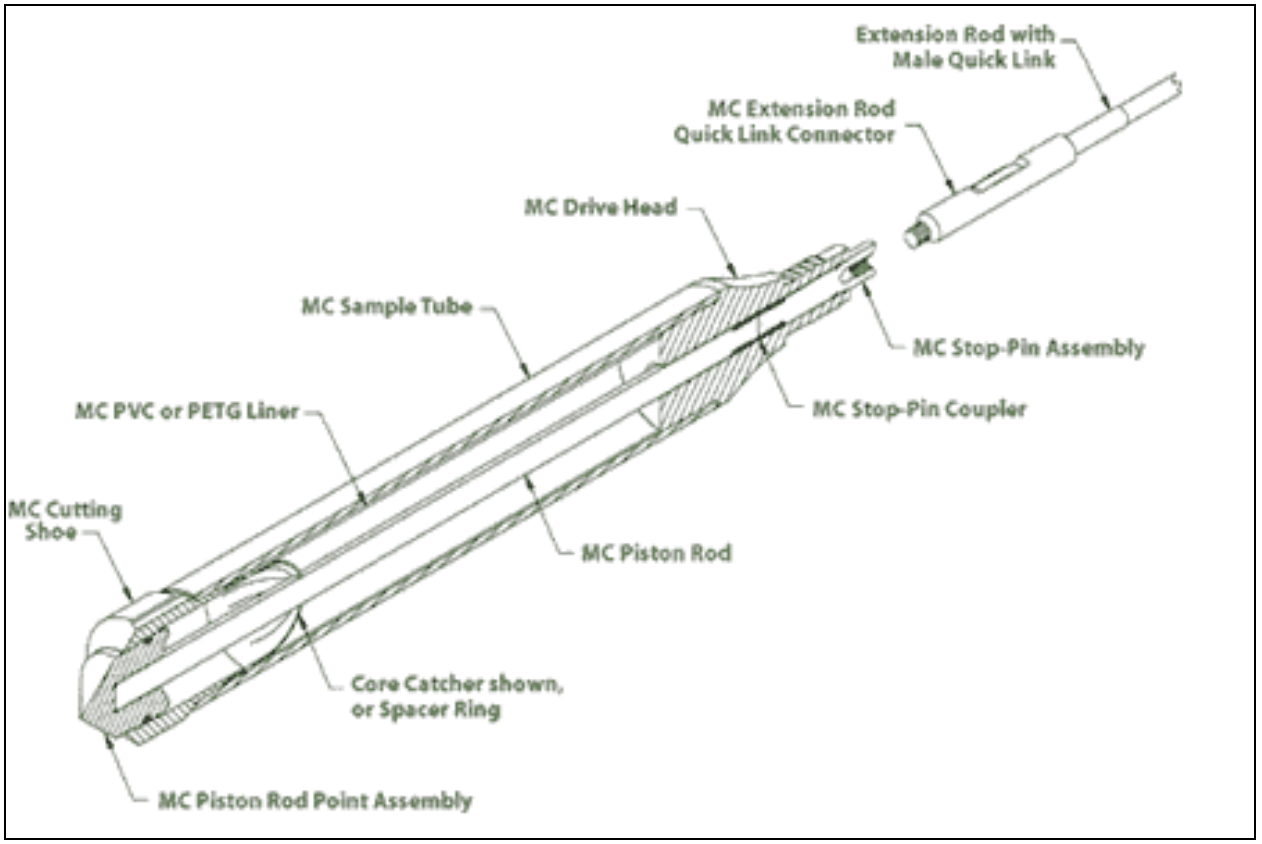
5. Attachments

Attachment A – GeoProbe® with Macrocore® Sampler Assembly

Attachment A

SOP DM-005

Attachment A – GeoProbe® with Macrocore® Sampler Assembly



Above: Diagram of a Macrocore® sampler

Right: A track-mounted GeoProbe ® Rig

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STANDARD OPERATING PROCEDURE

DM-006 Monitoring Well Construction and Installation

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the installation of overburden monitoring wells for environmental investigations. This SOP assumes the monitoring wells will be constructed of flush-joint polyvinyl chloride (PVC) pipe; the screened section will have factory-slotted openings. Well dimensions (well diameter, screen length, and screen slot-diameters) will be specified in the Work Plan and recorded in field notes, along with rationale for any changes from the work plan.

2. Execution

- Attachment A provides a diagram of typical shallow, intermediate, and deep groundwater monitoring well construction detail.
- During the monitoring well installation, record all pertinent information on Attachment B, Well Construction Form.
- Using a weighted tape, measure and record the depth of the completed soil boring (within the augers), if applicable, before beginning the well installation.
- Measure the depth to groundwater in the borehole over a 10 to 15 minute period to ensure that the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from the soil samples, if collected prior to well installation, to the measured water level in the borehole. If drilling water has been used during boring advancement, pump the water out of the borehole to the static water depth, based on examination of the soil samples, and monitor the recovery of groundwater until the level has stabilized.
- Choose the monitoring well screen and riser lengths so that the slotted section of the screen intersects the groundwater table, for shallow wells. If the borehole is deeper than the desired well depth, then fill the base of the borehole with sand.
- A minimum of a one-foot sump should extend to the bottom of the well if dense non-aqueous phase liquid (DNAPL) is suspected.
- Monitoring well screens should be constructed of either 2 or 4 inch inner diameter (ID) 0.01-inch or 0.02-inch slotted Schedule 40 PVC well screen.
- If DNAPL is suspected, the monitoring well should be constructed of either 2 or 4 inch ID 0.02-inch slotted Schedule 40 PVC well screen.
- Monitoring wells should be constructed of either 2 or 4 inch ID Schedule 40 threaded flush-jointed PVC. One-inch wells may be installed with prior approval of National Grid and the New York State Department of Environmental Conservation.

- Install and secure a bottom well cap. The bottom cap should be secured with either a threaded coupling and/or stainless steel screws. Do not use any kind glue to secure well sections together.
- Place at least 12 inches of clean uniformly graded medium quartz filter sand pack into the base of the borehole. Measure and record the depth of the boring. Temporarily cover the top of the riser pipe and lower the complete well plus riser into the borehole, with the base resting on the sand pack.
- Add adequate sand to surround the area around the slotted section. The filter sand should extend at least 2 feet above the top of the slotted section.
- Remove the drilling casing/augers from the borehole slowly, at a maximum of 2-foot intervals. As the drillers pour or use tamping rods to place the filter sand in the borehole, take frequent measurements of the depth-to-sand. Do not let the sand "bridge" in the annular space. Continue to observe the water level in the borehole.
- Place at least 1 foot of bentonite seal above the filter pack. If the seal is above the water table, use at least 5 gallons of potable water to hydrate the bentonite.
- If necessary, pump bentonite-cement grout using a tremie pipe into the bottom of the annular space to the ground surface. Grout should be mixed in approximately the following proportions: 7.5 gallons water to one 94-pound bag of cement to 2-4 pounds of pulverized bentonite. The grout must be mixed using the pump on the rig to ensure proper mixing. The protective casing should be set in the grout before it sets.
- The protective surface casing will be either a flush-mounted roadbox or a steel “stick up” pipe. The base of either type of casing should extend at least 1 foot into the grout below the ground surface (below the frost line) whenever possible.
- Cut the monitoring well riser flat and place a mark or "V"-notch or an arrow on the casing with an indelible marker at one point for surveying and groundwater measurements. Cut the well riser so that the top of the well is 3 to 6 inches below the top of the protective casing.
- Set bentonite-cement grout in the annular space between the protective casing and the borehole up to the ground surface. Slope the concrete radially away from the protective casing at the ground surface to promote surface water runoff. In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the roadbox FLUSH with the ground surface to avoid damage to the well.
- If the well is installed in a high-traffic area with a guardpipe, additional protection such as steel pole bumpers around the guardpipe may be necessary.
- Place a locking, vented cap on the well pipe.

- All well locations should be photodocumented in accordance with SOP FD-004, *Photo Documentation*.
- Label the protective well casing with a paint pen and tape out the location to nearby landmarks so that the well may be located in the future. Make sure to enter this information in the field notebook. If possible, place a brightly colored stake or other identifier adjacent to the well.
- Develop the well (see SOP DM-009, *Monitoring Well Development*).
- Upon completion, all newly installed monitoring wells will be surveyed. This will include the well location, ground surface elevation and measuring point elevation.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Site-specific conditions must be evaluated to determine appropriate materials.
- The water table will fluctuate seasonally and from year-to-year. Try and estimate the maximum high and low elevations of the water table from the current water table elevation and the season. Place the 10-foot screen so that at least 2 feet of the screen will extend above the top of the screen when water is at its highest. If very substantial fluctuations in the groundwater table are expected, a 15-foot screen is acceptable.
- Do not screen across different hydrostratigraphic units if possible (for example, outwash sands and till) unless specified in the Work Plan or approved by the Project Manager.
- If the formation is composed of a material that is uniformly coarser than the filter sand, the grain size of the filter sand must be increased. Consideration should also be given to changing the slot size on the well screen. Differences in average grain size should generally not be greater than a factor of two to four times.
- Do not use borehole/auger cuttings for backfill during monitoring well installation. If the cuttings are suspected to contain contamination which was identified during drilling, cuttings are to be containerized for later characterization and not used for filter pack materials.
- Do not screen across a confining layer (e.g., silt or clay). Backfill all confining layers with hydrated bentonite or grout.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

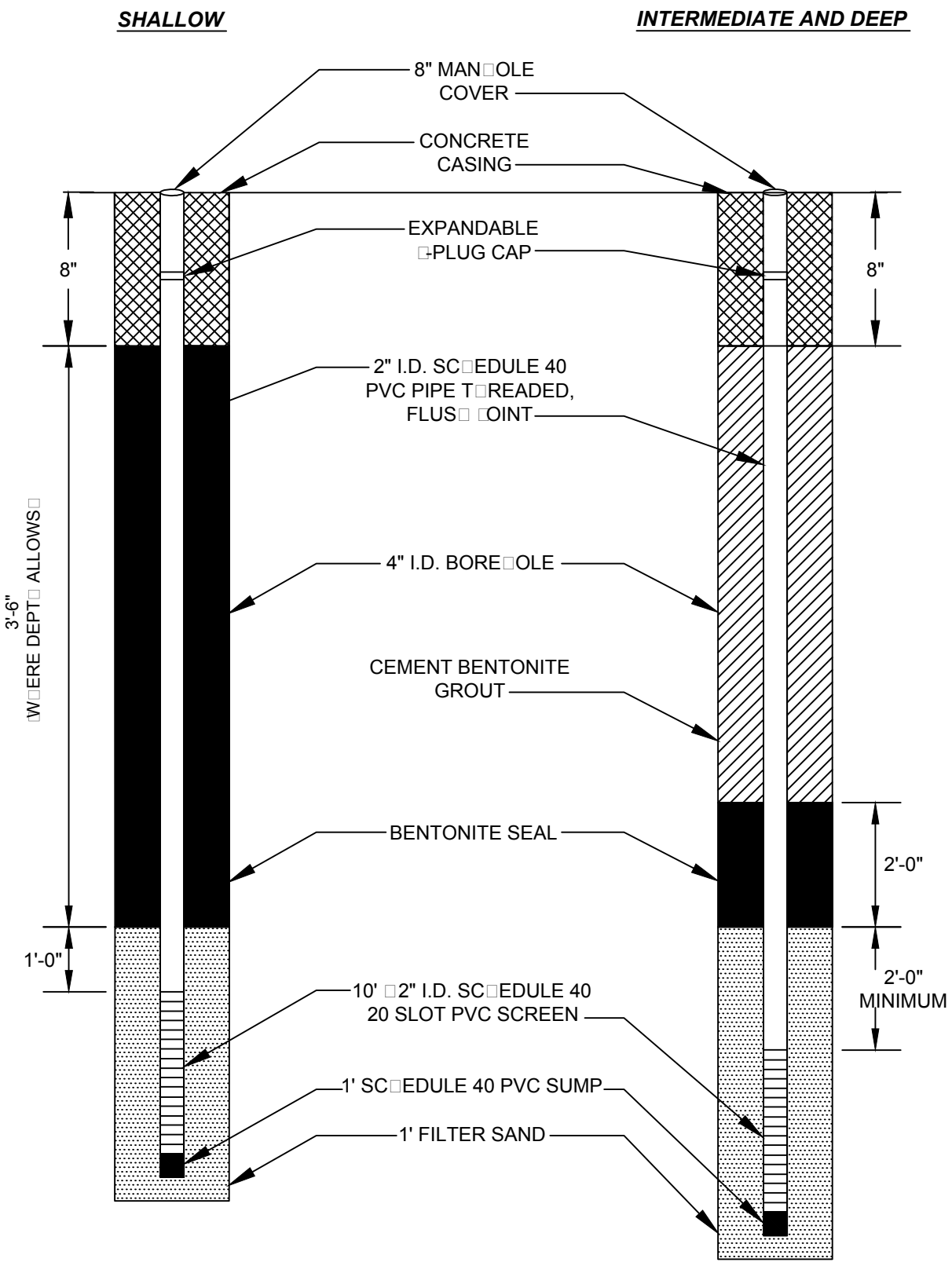
Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

5. Attachments

Attachment A – Typical Shallow, Intermediate, and Deep Groundwater Monitoring Well Construction Detail

Attachment B – Well Construction Form

Attachment A



NOT TO SCALE

GEI Consultants

TYPICAL SHALLOW, INTERMEDIATE AND DEEP GROUNDWATER MONITORING WELL CONSTRUCTION DETAIL

November 2010

Attachment B

WELL CONSTRUCTION FORM

Project _____ ID No. _____

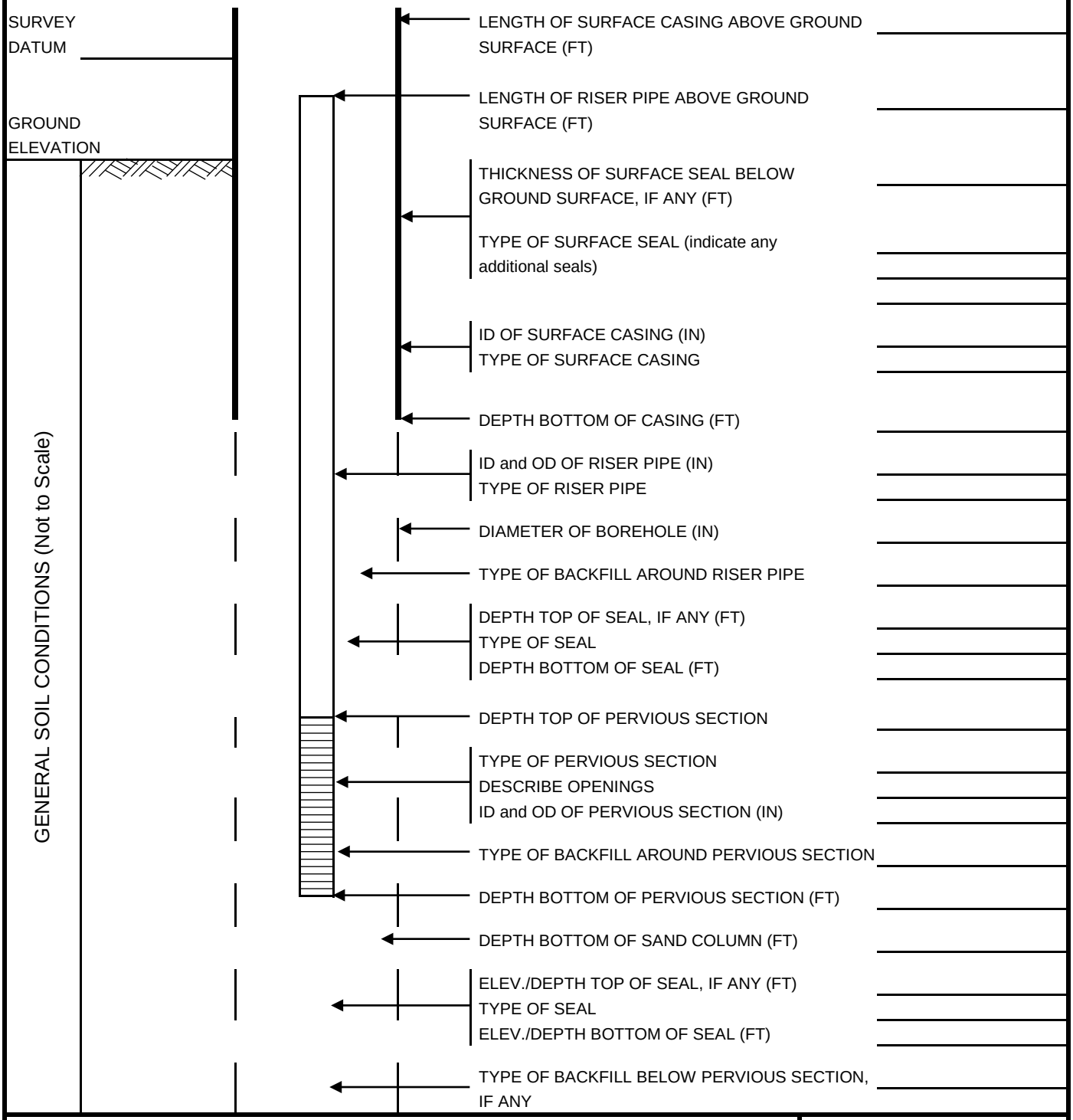
Location _____ **PG. 1 OF 1**

Client _____ Boring No. _____

Contractor _____ Driller _____ Location _____

Inspected by _____ Date Started _____

Checked by _____ Date Completed _____ Project No. _____



NOTES:

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STANDARD OPERATING PROCEDURE

DM-007 Monitoring Well Telescoping

1. Description

The method of monitoring well telescoping prevents the connection of two stratigraphic layers during monitoring well installation. Typically, these two stratigraphic layers are overburden and bedrock strata, or overburden deposits with a semiconfining layer.

2. Execution

- If work is to be conducted on private property, verify that National Grid has been notified (see SOP PP-001) and that National Grid has verified that access has been granted.
- Ensure that markout procedures outlined in PP-001, PP-002, and PP-003 have been completed.
  Prior to the start of drilling, the borehole location should be hand-cleared to a minimum of 5 feet below ground surface.
- Install large diameter casing (e.g., 6-inch outer diameter) to the top of the bedrock or semiconfining layer.
- Drill or core at least 10 feet into bedrock, or an appropriate thickness into the semiconfining layer, to confirm the presence of bedrock and adequately separate stratigraphic units (see precautions below).
- Freshly mixed grout is required. Depending on application, a mixture of Portland cement and bentonite meets most grouting requirements. For proper consistency, use no more than 6 gallons of water per 94-pound sack of cement. Add a few pounds of bentonite or hydrated lime per sack of cement for a better flow.
- Use a tremie pipe to deliver grout outside the casing. This method is not recommended for depths greater than 100 feet. You can use this method if the space between the casing and the borehole wall is large enough to contain a 1-inch tremie pipe. Use the following procedures to complete grouting using this method:
  i. Lower the tremie-pipe to the bottom of the borehole outside of the well casing. Make sure that the lower end of the casing is tightly seated at the bottom of the borehole.
  ii. Mix a sufficient quantity of grout and pump it through the tremie pipe or let it descend naturally. As the grout is placed, lift the tremie pipe slowly, but keep the lower end submerged in the grout.
  iii. Fill the casing with water as the grout is placed to balance the fluid pressure inside and outside the casing. Doing so prevents grout from leaking under the bottom of the casing.

iv. Allow the grout to set for a minimum of 24 hours.
v. Drill through the existing casing into bedrock to complete monitoring well. Install additional casing, polyvinyl chloride (PVC), or open borehole into bedrock.

3. Notes

- These operating procedures include drilling the borehole used to case off the overburden a minimum of 10 feet into a semiconfining layer. However, if dense non-aqueous phase liquid (DNAPL) and/or dissolved contamination is suspected or likely to be present in the weathered bedrock, the 10-foot casing requirement will hide the DNAPL from detection. In this case, an overburden well (with casing and screen) should be installed in the weathered bedrock and an outer steel casing installed 10 feet into bedrock would not be required.

4. References

Environmental Protection Agency, Region 4, "Environmental Investigation Standard Operating Procedures and Quality Assurance Manual, Chapter 6 – Design and Installation of Monitoring Wells," November 2001.

STANDARD OPERATING PROCEDURE

DM-008 Monitoring Well Development

1. Objective

To remove drilling fluids and fine soil particles that may be trapped in the monitoring well's sand pack and screen, and to set the sand pack so that it will function properly, and create good hydraulic communication between the well and the formation.

2. Execution

- Wait at least 48 hours following monitoring well installation before beginning development activities.
- Decontaminate all development equipment prior to use with, Alconox, and deionized-water rinses. See SOP QA-001, *Equipment Decontamination*.
- Calculate the volume of water in the monitoring well (one well volume).
- Record volume on Monitoring Well Development Record (Attachment A).
- Collect a sample of water from the monitoring well with a submersible pump, a bailer, or a water pump. Record the color and turbidity of the sample.
- Utilize one of the following methods for purging:
  - Surging;
  - Bailing;
  - Using a centrifugal pump and dedicated polyethylene tubing;
  - Positive displacement pumps and dedicated polyethylene tubing; and/or
  - Other methods recommended by the field geologist and approved by the National Grid Project Manage.
- Purge groundwater until it runs clear (<50 nephelometric turbity units [NTUs]) or until pH, temperature and specific conductivity stabilize as judged suitable by the field geologist.
- Well development should not exceed two hours for a single well.
- Measure the purge rate (gallons per minute) and total volume purged.
- Monitor the groundwater level in the well during development to determine if the pumping rate is sufficient to create a drawdown in the well.
- Collect groundwater samples every few well volumes during the pumping and record the physical properties (color and turbidity).
- Stop pumping when the purge water is relatively clear. Place a surge block in the monitoring well (if the method of development doesn't include a down-hole pump which serves as a surge block). Slowly

move the surge block up and down in the well. Periodically remove the surge block and purge the groundwater until it is relatively clear again. Start at a slow pace and progress to a faster surging action through time.

- Monitor the turbidity and color of the water during this procedure. The well is considered fully developed when all of the following criteria have been met:
  i. The volume of fluid added during drilling has been removed.
  ii. The water removed from the well is relatively free of fine-grained particles.
  iii. Record the volume of water pumped from the well and the physical properties (color, turbidity) of the water.

3. Notes

- Always remove groundwater with fine particles from the well before surging. The fine particles may be forced into the well screen by the surging action.
- Pump contaminated groundwater into an approved container (properly labeled drum or portable tank for transfer into frac tank).
- Use a bailer to develop monitoring wells that are installed in soils that are composed of fine-grained silts and clays. Pumping and mechanical surging is not recommended because these more vigorous techniques can cause fine particles to clog the filter pack.
- Sampling of groundwater should not occur within one weekafter development.

4. Calculations

To calculate the volume of water in the well, the following equation is used:
Well Volume (V) = Br^2 h (cf) **[Equation 1]**
where:

B = pi (3.14)
r = radius of monitoring well in feet (ft)
h = height of the water column in ft. [This may be determined by subtracting the depth to water from the total depth of the well as measured from the same reference point.]
cf = conversion factor in gallons per cubic foot (gal/ft^3) = 7.48 gal/ft^3. [In this equation, 7.48 gal/ft^3 is the necessary conversion factor.]

Monitor well diameters are typically 2-, 3-, 4-, or 6-inches. A number of standard conversion factors can be used to simplify the above equation using the diameter of the monitor well. The volume, in gallons per linear foot, for various standard monitor well diameters can be calculated as follows:
Where:

V (gal/ft) = Br^2 (cf) **[Equation 1]**

B = pi (3.14)
r = radius of monitoring well (ft)
cf = conversion factor (7.48 gal/ft^3)

For example, a 2 inch diameter well, the volume per linear foot can be calculated as follows:

V (gal/ft) = Br^2 (cf) **[Equation 2]**
= 3.14 (1/12 ft)^2 7.48 gal/ft^3
= 0.1631 gal/ft

NOTE: The diameter must be converted to the radius in feet as follows:

Well Diameter (inches) x 0.5 = Well Radius (ft) **[Equation 3]**

The volume in gallons/feet for the common size monitor wells are as follows:

Well diameter (inches)	Volume (gal/ft)
2	0.1631
3	0.3670
4	0.6524
6	1.4680

If you utilize the volumes for the common size wells above, Equation 1 is modified as follows:
Where:

Well volume = (h) (f) **[Equation 4]**

h = height of water column (ft)

f = the volume in gal/ft calculated from Equation 2

5. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

"The Methods & Mechanics of Well Development, Part 2 of 5," National Drillers Buyers Guide, March 1993, p. 17.

Standard References for Monitoring Wells (April 1991), Commonwealth of Massachusetts Department of Environmental Protection, WSC-310-91.

U. S. EPA Environmental Response Team Standard Operating Procedure SOP: 2044 ," Monitor Well Development" REV: 0.1, 10/23/01.

6. Attachments

Attachment A - Monitoring Well Development Record

Attachment A

Monitoring Well Development Record

Project: National Grid - **Well ID:** _____ **Date:** _____

Total Well Depth (from top of casing): _____

Depth to Water (from top of casing): _____

Well Diameter: _____

Pump Intake Depth: _____

Sampling Crew: _____

Purge Time: *Start:* _____ *Finish:* _____

Purging Method: _____

Sample Time: *Start:* _____ *Finish:* _____

Sampling Method: _____

Sample Analysis: _____

Purge Data

Sample Time	Flow Rate *(lpm/gpm)*	Volume Purged *(liters/gals.)*	pH *(std. Units)*	Conductivity *(mS/cm)*	Turbidity *(NTU)*	Dissolved Oxygen *(mg/l)*	Temperature *(Cel.)*	Salinity *(%)*	ORP *(mV)*	Comments/Observations
										Well Headspace PID =

Final Stabilization Data

Sample Time	Flow Rate *(lpm/gpm)*	Volume Purged *(liters/gals.)*	pH *(std. Units)*	Conductivity *(mS/cm)*	Turbidity *(NTU)*	Dissolved Oxygen *(mg/l)*	Temperature *(Cel.)*	Salinity *(%)*	ORP *(mV)*	Comments/Observations

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SUMMARY GUIDANCE

DM-009 General Guidance on Monitoring Well Abandonment

1. Objective

To properly abandon a monitoring well, preventing direct connections from surface conditions to the well screen zone.

When a decision is made to abandon a monitoring well, the borehole should be sealed in such a manner that the well can not act as a conduit for migration of contaminants from the ground surface to the water table or between aquifers. Guidelines for well abandonment are provided below but do not supersede state or local regulations. Make sure all well abandonment procedures adhere to appropriate regulations.

To properly abandon a well, the preferred method is to completely remove the well casing and screen from the borehole, clean out the borehole, and backfill with a cement or bentonite grout, neat cement, or concrete. In order to comply with New York State well abandonment requirements, the New York State Department of Environmental Conservation (NYSDEC) should be notified (if applicable) of monitoring well abandonment. However, some state requirements are not explicit, so a technically sound well abandonment method should be designed based on the site geology, well casing materials, and general condition of the well(s). In New York, the NYSDEC policy document titled, CP-43: Groundwater Monitoring Well Decommissioning Policy, should be followed. The document includes a flow chart to be used in selecting the appropriate decommissioning methods based upon the geologic and hydrogeologic conditions at the well site, the presence or absence of contamination in the groundwater and the original well construction details.

Execution

In accordance with NYSDEC's policy document referenced above, the four primary well decommissioning methods are:

- Grouting in-place.
- Perforating the casing followed by grouting in-place.
- Grouting in-place followed by casing pulling.
- Overdrilling and grouting with or without a temporary casing.

The methods and rationale for each of these methods is detailed in NYSDEC's policy document.

1.1. Borehole Abandonment

All soil borings not finished as monitoring wells or piezometers will be abandoned by adding neat cement grout or cement/bentonite grout via tremie pipe from the bottom of the borehole up to the ground surface. If the boring was completed via the hollow stem auger method, the borehole will be grouted as the augers are withdrawn, in the case of a direct-push soil boring, the borehole will be redrilled and pressure-grouted from the bottom depth of the borehole up. The neat cement grout will be mixed in accordance with the manufacturer's recommendations. The bentonite/cement grout will be mixed in the following relative proportions: 30 gallons of water to three 94-pound bags of cement to 25 pounds granular bentonite.

2. References

New York State Department of Environmental Conservation, *"CP-43: Groundwater Monitoring Well Decommissioning Policy"*, November 2009.

Environmental Protection Agency, Region 4, *"Environmental Investigation Standard Operating Procedures and Quality Assurance Manual, Chapter 6 – Design and Installation of Monitoring Wells,"* November 2001.

3. Attachment

Attachment A – CP-43: Groundwater Monitoring Well Decommissioning Policy

Attachment A

CP-43:Groundwater Monitoring Well Decommissioning Policy

New York State Department of Environmental Conservation

DEC POLICY

Issuing Authority: Commissioner Alexander B. Grannis	
Date Issued: November 3, 2009	**Latest Date Revised:**

I. Summary:

Groundwater monitoring wells provide essential access to the subsurface for scientific and engineering investigations (including monitoring wells installed for leak detection purposes). To a degree, every monitoring well is an environmental liability because of the potential to act as a conduit for pollution to reach the groundwater. To limit the environmental risk, a groundwater monitoring well must be properly decommissioned when its effective life has been reached. This document provides procedures to satisfactorily decommission groundwater monitoring wells in New York State. This policy also pertains to other temporary wells such as observation wells, test wells, de-watering wells and other small diameter, non-potable water wells. It does not pertain to water supply wells.

II. Policy:

Environmental monitoring wells should be decommissioned when:

1. they are no longer needed and re-use by another program is not an option; or
2. the well's integrity is suspect or compromised.

The method for decommissioning will be determined based upon well construction and environmental parameters. The method selected must be designed to protect groundwater and implemented according to current best engineering practices while following all applicable federal, state and local regulations. *Groundwater Monitoring Well Decommissioning Procedures* shall be maintained as an addendum to this policy.

This policy is applicable to all New York State Department of Environmental Conservation (DEC) programs that install, utilize and maintain monitoring wells for the study of groundwater, except monitoring wells for landfills regulated under 6 NYCRR Part 360 decommissioned in accordance with those regulations [*see* 6 NYCRR 360-2.11(a)(8)(vi)] and wells installed under the Oil, Gas and Solution Mining Law, Environmental Conservation Law Article 23. There is no specific time frame to dictate when to decommission a well; timing is dependent upon the use and condition of the well

and shall be determined on an individual basis. Best professional judgment must be exercised when using the decommissioning procedures. Outside of DEC use, this policy is mandatory when incorporated into the specifications of a state contract, an Order on Consent or a permit. In all other situations, it shall serve as guidance.

III. Purpose and Background:

This document establishes a monitoring well decommissioning policy and provides technical guidance. Synonyms for well decommissioning include “plugging,” “capping” and “abandoning. For consistency, only the term “decommissioning” is used within this document.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Since 1980, the DEC has installed, directed or overseen the installation of thousands of monitoring wells throughout New York for various state and federal programs, such as Superfund, solid waste, Resource Conservation and Recovery Act (RCRA), spill response, petroleum bulk storage and chemical bulk storage. This guidance addresses the environmental liability associated with this aging network of wells.

Within its boring zone, a successfully decommissioned well prevents the following:

1. Migration of existing or future contaminants into an aquifer or between aquifers;
2. Migration of existing or future contaminants within the vadose zone;
3. Potential for vertical or horizontal migration of fluids in the well or adjacent to the well; and
4. Any change in the aquifer yield and hydrostatic head, unless due to natural conditions.

Monitoring well construction in New York varies considerably with factors such as age of the well, local geology and either the presence or absence of contamination. The predominant type of monitoring well in New York is the shallow, watertable monitoring well constructed of polyvinyl chloride plastic (PVC). The best method for decommissioning should be selected to suit the conditions and circumstances. Each decommissioning situation is to be evaluated separately using this guidance before a method is chosen and implemented.

IV. Responsibility:

The Division of Environmental Remediation (DER) is responsible for updating this policy and the *Groundwater Monitoring Well Decommissioning Procedures* (addendum) in consultation with the Division of Solid and Hazardous Materials (DSHM) and the Division of Water (DOW). Compliance with the guidance does not relieve any party of the obligation to properly decommission a monitoring well. Oversight responsibility will be carried out by the DEC Regional Engineer.

V. Procedure:

Groundwater Monitoring Well Decommissioning Procedures, the addendum to this policy, provides guidance on proper decommissioning of monitoring wells in New York State.

VI. Related References:

- Groundwater Monitoring Well Decommissioning Procedures, October 1986. Prepared by Malcolm Pirnie, Inc. for the New York State Department of Environmental Conservation, Division of Environmental Remediation.
- Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities, ASTM D 5299-99. American Society for Testing and Materials (ASTM). Philadelphia. 2005.
- 6 NYCRR Part 360 Solid Waste Management Facilities, New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials.
- Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, New York State Department of Environmental Conservation, Region 1 - Water Unit, undated.
- Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034, United States Environmental Protection Agency (EPA).

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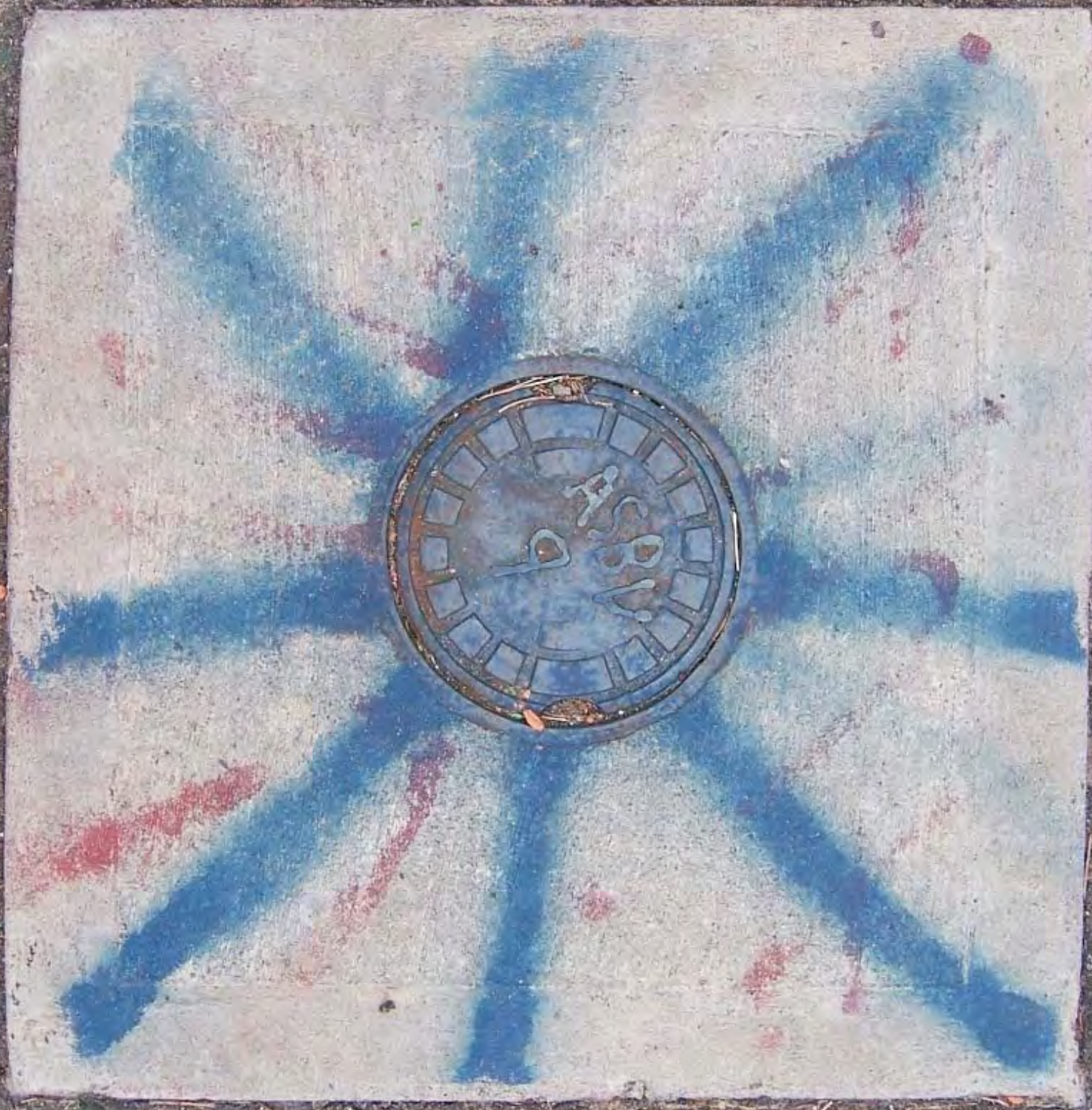
Final - August 2009

GROUNDWATER MONITORING WELL DECOMMISSIONING PROCEDURES



New York State Department of Environmental Conservation
Division of Environmental Remediation

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INTRODUCTION

This document, *Groundwater Monitoring Well Decommissioning Procedures*, is the addendum to CP-43, Groundwater Monitoring Well Decommissioning Policy, which provides acceptable procedures to be used as guidance when decommissioning monitoring wells in New York State. Please note that this document does not address some site-specific special situations that may be encountered in the field. Compliance with the procedures set forth in this document does not relieve any party of the obligation to properly decommission a monitoring well.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Previous versions of this guidance have been issued since 1995. Originally developed as a specification for well decommissioning at Love Canal, the procedures were rewritten to make them applicable across the state. From an engineering standpoint, the guidance has changed very little. Most situations do not require a complex procedure.

If you have any questions, please contact Will Welling at (518) 402-9814.

Sincerely,

Gerald J. Rider, Jr., P.E.
Chief, Remedial Section D
Remedial Bureau E
Division of Environmental Remediation

1.0 PREPARATION

If an unneeded monitoring well remains in good usable condition, an alternative to decommissioning might be the reuse by another agency program. DEC encourages reuse in situations where a well will continue to be used and cared for responsibly.

When reuse is not an option, the first step in the well decommissioning process is to review all pertinent well construction information. One must know the well depth and construction details. GPS coordinates and permanent labeling (if available) will be useful in confirming the well to be decommissioned. An inspection must be performed prior to decommissioning in order to verify the construction and condition of each well. Specific details and subsurface conditions form the basis for decisions throughout the decommissioning process.

Well Details

1. Is the well a single stem riser (all one diameter)?
2. Is the well a simple overburden well (no penetration into bedrock)?
3. Does the well riser consist of telescoping diameters of pipe which decrease with depth?
4. Is the well seal compromised (leaking, inadequate or damaged)?
5. If the well is PVC, is it 25 feet or shallower and not grouted into rock?
6. Can the riser be pulled and is removal of the well desired?
7. Is the well a bedrock well?
8. If the monitoring well is a bedrock well, does it have an open hole?
9. Is there a well assembly (riser and screen) installed within the bedrock hole?

Subsurface Conditions

10. Is the soil contaminated?
11. Does the well penetrate a confining layer?
12. If the well penetrates a confining layer, might overdrilling or casing pulling cause contamination to travel up or down through a break in the confining layer?
13. Does the screened interval cross multiple water-bearing zones?

For additional collection and verification of information, the "Monitoring Well Field Inspection Log" (Figure 1) can be used during a field inspection. After the well has been located and the information gathered, one is ready to select the decommissioning procedure in accordance with Section 2.

Special conditions, such as access problems, well extensions through capped and covered non-Part 360 landfills and seasonal weather patterns affecting construction, should be assessed in the planning stage. Decommissioning work requiring the use of heavy vehicular equipment on landfill caps should be scheduled during dry weather (if possible) so as to minimize damage to the cover. If work must be performed during the spring, winter or inclement weather, special measures to reduce ruts should be employed to maintain the integrity of a completed landfill cover system. As an example, placement of plywood under vehicular equipment can eliminate deep ruts that would require repair.

2.0 DECOMMISSIONING METHODS

The primary rationale for well decommissioning is to remove any potential groundwater pathway. A secondary rationale, often important to the property owner or owner of the well, is to physically remove the well. Removed well materials may be recycled and will not interfere with future construction excavation. The previous versions of these decommissioning procedures have stressed that physical removal of the well by pulling is preferable to leaving casing in the ground. Due to the added effort, expense and risk involved with pulling, the decision of whether to pull or not should be a separate consideration aside from selecting the sealing procedure.

One should select a decommissioning procedure that takes into account the geologic and hydrogeologic conditions at the well site; the presence or absence of contamination in the groundwater; and original well construction details. The selection process for well decommissioning procedures is provided by the flow chart, Figure 2. Answers to the questions

in the preceding section are the input for this flow chart. The four primary well decommissioning methods are:

1. Grouting in-place;
2. Perforating the casing followed by grouting in-place;
3. Grouting in-place followed by casing pulling;
4. Over-drilling and grouting with or without a temporary casing.

In a complex situation, one or more decommissioning procedures may be used for different intervals of the same well.

The remainder of Section 2 discusses the well decommissioning methods and the selection process. Refer to Figure 2 for a flow chart diagram of the complete procedure selection process. The DEC Project Manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions and professional judgment.

2.1 Grouting In-Place

Grouting in-place is the simplest and most frequently used well decommissioning method and grouting itself is the essential component of all the decommissioning methods. The grout seals the borehole and any portion of the monitoring well that may be left in the ground. Because dirt and foreign objects can fall into an open well, whenever possible a well should be sealed first with grout before attempting subsequent decommissioning steps.

For the purpose of these decommissioning procedures, the well seal is defined as the bentonite seal above the sand pack. Aside from obvious channeling by in-flowing surface water around the well, an indication of the well seal integrity may be obtained through review of the boring logs and/or a comparison of groundwater elevations if the well is part of a cluster. Any problems noted on the boring logs pertaining to the well seal, such as bridging of bentonite pellets or running sands, or disparities between field notes (if available) and the well log would indicate the potential for a poor (compromised) well seal.

If the well seal is not compromised and there is no confining layer present, a single-stem, 2-inch PVC, monitoring well can be satisfactorily decommissioned by grouting it in-place. If the seal is compromised, casing perforation may be called for as discussed in Section 2.2.

As discussed in Section 2.4 and its sub-sections, this method is specified for the bedrock portion of a well, and is used for decommissioning small diameter cased wells. Grouting in-place involves filling the casing with grout to a level of five feet below the land surface, cutting the well casing at the five-foot depth, and removing the top portion of the casing and associated well materials from the ground. The casing must be grouted according to the procedures in Section 6. In addition, the upper five feet of the borehole is filled to land surface and restored according to the procedures described in Section 7.

For open-hole bedrock wells, the procedure involves filling the opening with grout to the top of rock according to the procedures in Section 5. A thicker grout may be required to fill any bedrock voids. If excessive grout is being lost down-hole, consider grouting in stages to reduce the pressure caused by the height of the grout column.

The standard mix with the maximum amount of allowable water will be required to penetrate the well screen and sand pack when a well assembly has been installed within a bedrock hole. For an assembly such as this, the grout should be mixed thinly enough to penetrate the slots and sand pack. The grout mixes are discussed in Sections 6.1 and 6.2.

2.2 Casing Perforating/Grouting In-Place

Casing perforation followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the annulus was allowed to be back-filled with cuttings. The grout will squeeze through the perforations to seal any porous zones along the outside of the casing. The procedure involves puncturing, cutting or splitting the well casing and screen followed by grouting the well. A variety of commercial equipment is available for perforating casings and screens in wells with four-inch or larger inside diameters. Due to the diversity of applications, experienced contractors must recommend a specific technique based on site-specific conditions. A minimum of four rows of perforations several inches long around the circumference of the pipe and a minimum of five perforations per linear foot of casing or screen is recommended (American Society for Testing and Materials, Standard D 5299-99, 1999). After the perforating is complete, the borehole must be grouted according to the procedures in Section 6 and the upper five feet of borehole restored according to the procedures in Section 7.

2.3 Casing Pulling

Casing pulling should be used in cases where the materials of the well assembly are to be recycled, or the well assembly must be removed to clear the site for future excavation or re-development. Casing pulling is an acceptable method to use when no contamination is present; contamination is present but the well does not penetrate a confining layer; and when both contamination and a confining layer are present but the contamination cannot cross the confining layer. Additionally, the well construction materials and well depth must be such that pulling will not break the riser. When contamination is likely to cross the confining layer during pulling, a temporary casing can be used. See Section 2.4.

Casing pulling involves removing the well casing by lifting. Grout is to be added during pulling; the grout will fill the space once occupied by the material being withdrawn. An acceptable procedure to remove casing involves puncturing the bottom of the well or using a casing cutter to cut away the screen, grouting, using jacks to free casing from the hole, and lifting the casing out by using a drill rig, backhoe, crane, or other suitable equipment. Additional grout must be added to the casing as it is withdrawn. Grout mixing and placement procedures are provided in Section 6. In wells or well points in which the bottom cannot be punctured, the casing or screened interval will be perforated or cut away prior to being filled with grout. This procedure should be followed for wells installed in collapsible formations or for highly contaminated wells.

At sites in which well casings have been grouted into the top of bedrock, the casing pulling procedure should not be attempted unless the casing can be first cut or freed from the rock.

2.4 Over-Drilling

Over-drilling is the technique used to physically remove an entire monitoring well, its sand pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over-drilling will be required. Over-drilling is called for when a riser can't be pulled and it penetrates a confining layer. Compared to the other procedures, over-drilling is the least common method of well decommissioning.

A "temporary casing" may be necessary when extraordinary conditions are present, such as a high concentration of mobile contaminants in the overburden, depth to water is shallow, there is poor construction documentation or shoddy construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling / pulling /grouting within this casing. The casing is withdrawn at the end of pulling, grouting and (perhaps) drilling. If the confining layer is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is used where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled. The over-drilling method should:

- Follow the original well bore;
- Create a borehole of the same or greater diameter than the original boring; and
- Remove all of the well construction materials.

In over-drilling the difficulty lies in keeping the augers centered on the old well as the bit is lowered; it will tend to wander off. As a precaution, the well column should be filled with grout before over-drilling. Then without allowing the grout to dry, the driller proceeds with over-drilling the well. Grouting first guarantees that if the drill wanders off the old well and the effort is less than 100% successful, the remaining well portion will at least have been grouted. There are many methods for over-drilling. Please note that the following methods are not suitable for all types of casing, and the advice of an experienced driller should be sought.

- Conventional augering (i.e., a hollow stem auger fitted with a pilot bit). The pilot bit will grind the well construction materials, which will be brought to the well surface by the auger.
- A conventional cable tool rig to advance "temporary" casing having a larger diameter than the original boring. The cable tool kit is advanced within the casing to grind the well construction materials and soils, which are periodically removed with large diameter bailer. This method is not applicable to bedrock wells.

- An over-reaming tool with a pilot bit nearly the same size as the inside diameter of the casing and a reaming bit slightly larger than the original borehole diameter. This method can be used for wells with steel casings.

- A hollow-stem auger with outward facing carbide cutting teeth having a diameter two to four inches larger than the casing.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout as with casing removal by pulling.

In all cases above, over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials. Oversight attention should be focused on the drill cuttings, looking for fragments of well materials. Absence of these indicators is a sign that the drill has wandered off the well. If wandering is suspected, having previously filled the well with grout, the remaining portion which cannot be over-drilled can be considered grouted in-place. When the over-drilling is complete, grout should be tremied within the annular space between the augers and well casings. The grout level in the borehole should be maintained as the drilling equipment and well materials are sequentially removed. As with all the other methods, the upper five feet of borehole should be restored according to the procedures in Section 7.

3.0 SELECTION PROCESS AND IMPLEMENTATION

The decommissioning procedure selection flow chart, Figure 2, is to be used to select decommissioning methods. The selection process first identifies the basic monitoring well type. There are only two types of monitoring wells described in this guidance, overburden wells and bedrock wells. Bedrock wells typically have an overburden portion which in the selection process is to be treated as an overburden well. Techniques are specified for wells based upon their type and the other physical conditions present. Decommissioning techniques called for by the selection process have their practical limits; construction details dictate when a well stem can be pulled without breaking and when it cannot be pulled. The DEC project manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions, budgetary concerns and professional judgment. The remainder of this section will discuss types of monitoring wells in various settings along with recommended decommissioning techniques.

3.1 Bedrock Wells

Referring to Figure 2 and Section 2.1, if the well extends into bedrock, the rock hole portion of the well is to be grouted in-place to the top of the rock. The grout mix, however, may vary according to the conditions. A thicker grout may be required to fill voids and a thinner grout may be necessary to penetrate well screen and sand pack. Refer to the grout mixture specifications given in Section 6.1 and 6.2.

Prior to grouting, the depth of the well will be measured to determine if any silt or debris has plugged the well. If plugging has occurred, all reasonable attempts to clear it should be made before grouting. The borehole will then be tremie grouted according to Section 6.4 from the bottom of the well to the top of bedrock to ensure a continuous grout column.

After the rock hole is grouted, the overburden portion of the well is decommissioned using appropriate techniques described below. If the bedrock extends to the ground surface, grouting can extend to the ground surface or to slightly below so that the site can be restored as appropriate in accordance with Section 7.

3.2 Uncontaminated Overburden Wells

For overburden wells and the overburden portion of bedrock wells, the first factor in determining the decommissioning method is whether the overburden portion of the well exhibits contamination, as determined through historical groundwater and/or soil sampling results. If the overburden is uncontaminated, the next criteria considers whether the well penetrates a confining layer. In the case that the overburden portion of the well does not penetrate a confining layer, the casing can either be tremie-grouted and pulled or tremie grouted and left in place. As a general rule, PVC wells greater than 25-feet deep should not be pulled unless site-specific conditions or other factors indicate that the well can be pulled without breaking. If the well cannot be pulled, the well should be grouted in-place as accordance with Sections 2.1 and 2.2.

If a non-telescoped overburden well penetrates a confining layer, the casing should be removed by pulling (if possible) in accordance with Section 2.3. If the casing cannot be removed by pulling, the well should be grouted in-place or where complete removal is required, removed by over-drilling. Over-drilling will be based upon the site-specific conditions and requirements. If pulling is attempted and fails (i.e., a portion of the riser breaks) the remaining portion of the well should be removed by using the conventional augering procedure identified in Section 2.4. Note that if the riser is broken during pulling, it is highly unlikely that the driller will be able to target it to over-drill it. This is the reason why all wells should be grouted first. In all cases, after the well construction materials have been removed to the extent possible, the borehole will be grouted in accordance with Section 6 and the upper five feet will be restored in accordance with Section 7.

3.3 Contaminated Overburden Monitoring Wells/Piezometers

Contamination in the overburden plays a role in the selection process. Any contamination present in the overburden must not be allowed to spread as a result of the decommissioning construction. For wells and piezometers suspected or known to be contaminated with light non-aqueous phase liquid (LNAPL) and/or dense non-aqueous phase liquid (DNAPL), often referred to as “product,” the decision to decommission the well should be reviewed. Such gross contamination is a special condition and requires design of the decommissioning procedure. If decommissioning is determined to be the proper course of action, measurement of the non-aqueous phase liquid volume will be determined and this liquid will be removed.

If an overburden well (or the overburden portion of a bedrock well) is contaminated with LNAPL, DNAPL and /or dissolved fractions as indicated by historical sampling results, one must evaluate the potential for contamination to cross an overburden confining layer (if one exists) during decommissioning. A rock or soil horizon of very low permeability is known as a confining layer. Contamination in the overburden lying above a confining layer is a significant condition to recognize. To prevent mobile contaminants from crossing a confining layer during pulling or over-drilling, a temporary casing should be installed to isolate the work zone. One should follow the procedure selection flow chart. Some contaminated conditions call for over-

drilling or a specially designed procedure.

A well in contaminated overburden may be grouted in-place as long as the grout fully seals the well and boring zone. If a well in contaminated overburden was constructed allowing formation collapse as annular backfill or if the well has a compromised well seal, one must either physically remove the well or thoroughly perforate the riser and grout it in-place.

If physical removal of the well is required and the overburden contaminants are likely to be dragged upward or downward during decommissioning, a temporary casing should be used to seal off the construction work zone. Casing pulling and overdrilling can be safely accomplished within the temporary casing. Section 2.4 discusses the temporary casing technique.

3.4 Telescoped Riser

If the riser is telescoped in one or more outer casings, the decommissioning approach depends upon the integrity of the well seal. If there is no evidence that the well seal integrity is compromised, the riser should be grouted in-place in accordance with Sections 2.1 or 2.2 and the upper 5 feet of the well surface should be restored in accordance with Section 7. If indications are that the well seal is not competent, it will be necessary to design and implement a special procedure to perforate and grout or remove the well construction materials. The presence and configuration of the outer casing(s) will be specific in the individual wells and will be a key factor in the decommissioning approach. The special procedure must mitigate the potential for cross-contamination during removal of the well construction materials.

4.0 LOCATING AND SETTING-UP ON THE WELL

Prior to mobilizing to decommission a monitoring well, one should notify the property owner and/or other interested parties including the governing regulatory agency. It is advisable that when at the well location, one should review the proposed well decommissioning procedure. Verify well locations and identification by their identifying markers and GPS coordinates. Lastly, verify the depth of each well with respect to depth recorded on the well construction log.

5.0 REMOVING THE PROTECTIVE CASING

Most monitoring wells installed in non-traffic locations are finished with an elevated, protective casing (guard pipe) and a concrete rain pad. Wells at gasoline stations, usually being in high-traffic areas, are typically finished with a flush-mount, curb box and protective 8" dia steel inspection plate rather than a stick-up riser. The curb box is usually easily removed from around the flush-mount well before pulling or over-drilling. In the case of stick-up wells, the riser pipe may be bonded to the guard pipe and rain pad. When the protective casing and concrete pad of a stick-up monitoring well are "yanked out," a PVC riser will typically break off at the bottom of the guard pipe several feet below grade. Once this happens, it may become impossible to center a drill rig upon the well. The riser may become splintered and structurally unstable for pulling. Unless grouted first, the well may fill with dirt. Before pulling a casing or over-drilling a well, a method must be devised for removing these protective surface pieces without jeopardizing the remaining decommissioning effort.

Generally, unless the protective casing is loose and can be safely lifted off by hand, *one*

should fill the monitoring well with grout before removing the outer protective casing. This will ensure that the well is properly sealed regardless of any problems later when removing the protective casing. Remove the protective casing or road box vault initially only if the stick-up or vault will interfere with subsequent down-hole work which must be done before grouting. This down-hole work may include puncturing, perforating or cutting the screen or riser. But as a general procedure don't remove the protective casing or road box until after initial grouting is complete.

The procedure for removing the protective casing of a well depends upon the decommissioning method specified for the monitoring well. The variety of protective casings available preclude developing a specific removal procedure but often one can simply break up the concrete seal surrounding the casing and jack or hoist the protective casing out of the ground. A check should be made during pulling to ensure that the inner well casing is not being hoisted with the protective casing. If this occurs, the well casing should be cut off after the base of the protective casing is lifted above the land surface. At well locations where the riser has been extended, the burial of a previous concrete pad may require the excavation of soil to the top of the concrete pad to remove the well.

Steel well casing should be removed approximately five feet below the land surface so as to be below the frost line and out of the way of any subsequent shallow digging. The upper five feet of casing and the protective casing can be removed in one operation if a casing cutter is used.

Waste handling and disposal must be consistent with the methods used for the other well materials unless an alternate disposal method can be employed (i.e., steam cleaning followed by disposal as non-hazardous waste).

6.0 SELECTING, MIXING, AND PLACING GROUT

This section gives recipes for the “standard grout mixture” and the thicker “special grout mixture.” Mixing and placing grout is also discussed in this section. The goal of well decommissioning is to eliminate the capability of water to travel up or down within the volume of the former well and its boring. Success depends upon the correct grout mixture and placement where it is needed. There are two types of grout mixes that may be used to seal monitoring wells: a standard mix and a special mix. Both mixes use Type 1 Portland cement and four percent bentonite by weight. However, the special mix uses a smaller volume of water and is used in situations where excessive loss of the standard grout mix is possible (e.g., highly-fractured bedrock or coarse gravels).

6.1 Standard Grout Mixture

For most boreholes, the following standard mixture will be used:

- One 94-pound bag Type I Portland cement;
- 3.9 pounds powdered bentonite; and
- 7.8 gallons potable water.

Slightly more water may be used in order to penetrate a sand pack when a well screen transects multiple flow zones. This mixture results in a grout with a bentonite content of four percent by weight and will be used in all cases except in boreholes where excessive use of grout is anticipated. In these cases a special thicker mixture will be used.

6.2 Special Mixture

In cases where excessive use of grout is anticipated, such as high permeability formations and highly fractured or cavernous bedrock formations, the following special mixture will be used:

- one 94-pound bag type I Portland cement;
- 3.9 pounds powdered bentonite;
- 1 pound calcium chloride; and
- 6.0-7.8 gallons potable water (depending on desired thickness).

The special mixture results in a grout with a bentonite content of four percent by dry weight. It is thicker than the standard mixture because it contains less water. This grout is expected to set faster than the Standard Grout Mixture due to the added calcium chloride. The least amount of water that can be added for the mixture to be readily pumpable is 6 gallons per 94-pound bag of cement.

6.3 Grout Mixing Procedure

To begin the grout-mixing procedure, calculate the volume of grout required to fill the borehole. If possible, the mixing basin should be large enough to hold all of the grout necessary for the borehole.

Mix grout until a smooth, homogeneous mixture is achieved. Grout can be mixed manually or with a mechanized mixer. Colloidal mixers should not be used as they tend to excessively decrease the thickness of the grout for the above recipes.

6.4 Grout Placement

This guidance requires that grout be placed in the well from the bottom to the top by means of a "tremie." A tremie is a pipe, a hose or a tube extending from the grout supply to the bottom of the well. The tremie delivers the grout all the way down through the water column without its being diluted and mixed with the water that may be present in the well. The tremie pipe or tube is withdrawn as (or after) the well is filled with grout.

Using the tremie, grout is placed in the borehole filling from the bottom to the top. Two-inch and larger wells should use tremie tubing of not less than 1-inch diameter. Smaller diameter wells will call for a smaller tremie pipe. Grout will then be pumped in until the grout appears at the land surface (when grouting open holes in bedrock, the grout level only needs to reach above the bedrock surface). Any groundwater displaced during grout placement, if known to be contaminated, will be contained for proper disposal.

At this time the rate of settling should be observed. If grouting the well in place, the well

casing remains in the hole. But if the decommissioning method has involved down-hole tools such as hollow-stem augers or temporary casing for overdrilling, these will be removed from the hole. As each section is removed, grout will be added to keep the level between 0 and 5 feet below grade. If the grout level drops below the land surface to an excessive degree, an alternate grouting method must be used. One possibility is to grout in stages; i.e., the first batch of grout is allowed to partially cure before a second batch of grout is added.

As previously described in Section 5.0, the outer protective casing "stick-up" should be removed only after a well has been properly filled with grout. This will ensure that the well is properly sealed regardless of any breakage which may occur when removing the stick-up. It is important to reiterate that when either casing pulling or over-drilling are required, due to the uncertainty of successfully pulling a well or over-boring a well, we insist that the driller tremie grout the well first. Then without allowing the grout to dry, the driller proceeds with pulling the casing or over-drilling the well.

Upon completion of grouting, ensure that the final grout level is approximately five feet below land surface. A ferrous metal marker will be embedded in the top of the grout to indicate the location of the former monitoring well. Lastly, a fabric "utility" marking should be placed one foot above the grout so an excavator can see it clearly.

7.0 BACKFILLING AND SITE RESTORATION

The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

8.0 DOCUMENTATION

A form which may be used in the field to record the decommissioning construction is included as Figure 3. Additional documentation may be required by a DEC project manager and samples are included in Appendix A. Programs within the DEC that maintain geographic data on monitoring wells strive to keep that data up to date. Owners of these data sets must be notified when a well is decommissioned. Historical groundwater quality data is linked to monitoring well locations so when a well is decommissioned, existing GIS data must be updated to reflect that fact but the coordinate location in the GIS database should not be eliminated. A metal detector may not be able to detect a deeply buried marker so if this locator is important for future utility runs or foundations, a map should be submitted to the property owner and the town engineer showing the decommissioned well locations. Global Positioning System (GPS) coordinates should be indicated on this map. Lastly, whatever documentation is produced should be provided to the property owner, the DEC, and all other parties involved.

9.0 FIELD OVERSIGHT

Over-drilling requires careful observation to detect whether the drill has wandered off the well. Grout preparation and tremie work should be carefully observed. The successful implementation of a decommissioning work plan depends upon proper direction, observation and oversight. Methods to be employed must be clearly worked through and all parties must understand what they have to do before going into the field. Flexibility is allowed where necessary but the work effort must be thorough and effective to protect our groundwater.

10.0 RELATED REFERENCES

- *Groundwater Monitoring Well Decommissioning Procedures*, October 1986. Prepared by Malcolm Pirnie, Inc., for the New York State Department of Environmental Conservation, Division of Environmental Remediation.

- American Society for Testing and Materials, A.S.T.M. D 5299-99, Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities. A.S.T.M.. Philadelphia. 2005.

- New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities.

- New York State Department of Environmental Conservation, Region I - Water Unit, Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, undated.

- United States Environmental Protection Agency, The Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034.

FIGURES

FIGURE 1 - MONITORING WELL FIELD INSPECTION LOG

FIGURE 2 - DECOMMISSIONING PROCEDURE SELECTION

FIGURE 3 - WELL DECOMMISSIONING RECORD

APPENDICES

APPENDIX A - REPORTS

APPENDIX A1 - INSPECTOR'S DAILY REPORT

APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

APPENDIX A3 - CORRECTIVE MEASURES REPORT

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FIGURE 1

MONITORING WELL FIELD INSPECTION LOG

FIGURE 1

SITE NAME:

SITE ID.: _____
INSPECTOR: _____
DATE/TIME: _____
WEll ID.: _____

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back).....		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL: .....

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED..... _____
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable) _____
PROTECTIVE CASING MATERIAL TYPE: ..... _____
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches): ..... _____

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): ..... _____
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): ..... _____
MEASURE WELL DIAMETER (Inches): ..... _____
WELL CASING MATERIAL: ..... _____
PHYSICAL CONDITION OF VISIBLE WELL CASING: ..... _____
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE ..... _____
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES..... _____

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

REMARKS:

FIGURE 2

DECOMMISSIONING PROCEDURE SELECTION

NYSDEC Monitoring Well Decommissioning Procedure Selection

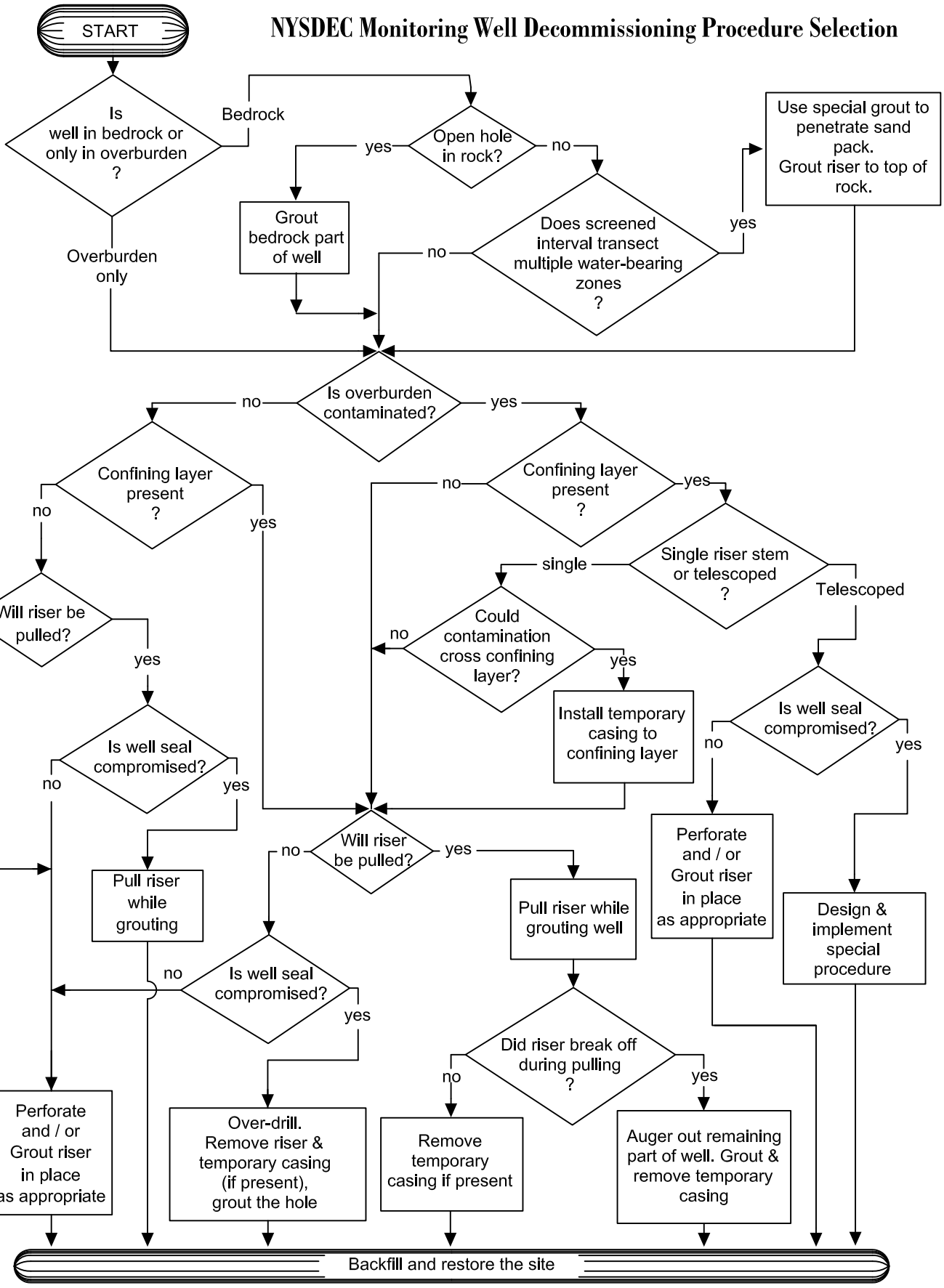


FIGURE 2

FIGURE 3

WELL DECOMMISSIONING RECORD

FIGURE 3

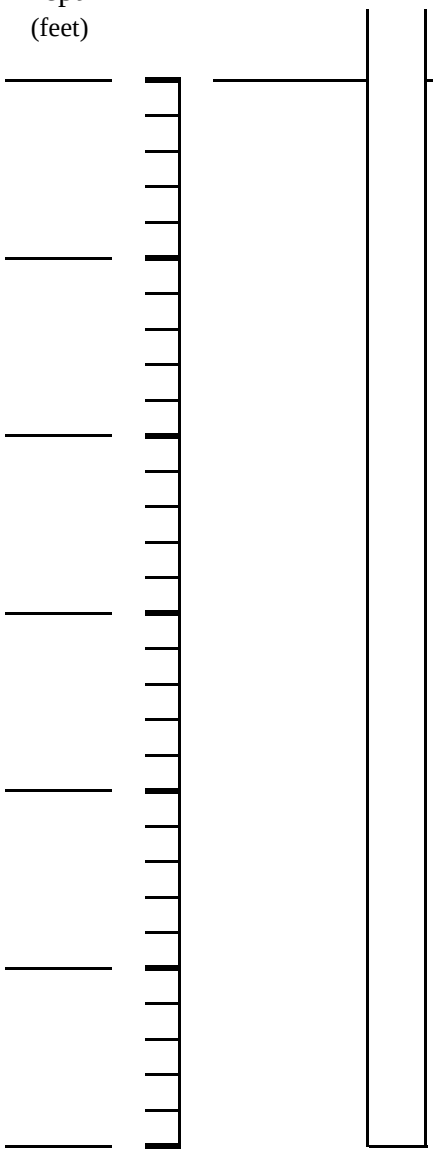
WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING	
Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	
CASING PULLING	
Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	
CASING PERFORATING	
Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	
GROUTING	
Interval grouted (FBLS)	
# of batches prepared	
For each batch record:	
Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

APPENDIX A - REPORTS

APPENDIX A1 - INSPECTOR'S DAILY REPORT

APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

APPENDIX A3 - CORRECTIVE MEASURES REPORT

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Appendix A1

Inspector's Daily Report

CONTRACTOR:
ADDRESS:

TELEPHONE:
LOCATION _____ FROM _____ TO _____
WEATHER _____ TEMP _____ A.M. _____ P.M. _____ DATE _____

CONTRACTOR'S WORK FORCE AND EQUIPMENT											
DESCRIPTION	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*
Field Engineer						Equipment			Front Loader Ton		
Superintendent			Ironworker			Generators			Bulldozer		
						Welding Equip.					
Laborer Foreman			Carpenter								
Laborer									Backhoe		
Operating Engineer			Concrete Finisher								
Carpenter						Paving Equip. & Roller					
						Air compressor					

SEE REVERSE SIDE FOR SKETCH YES ☐ NO ☐ _____

WORK PERFORMED: _____

PAY ITEMS

CONTRACT		STA		DESCRIPTION	QUANTITY	REMARKS
Number	ITEM	FROM	TO			

TEST PERFORMED: _____
PICTURES TAKEN: _____

VISITORS: _____

QA PERSONNEL
SIGNATURE _____

REPORT NUMBER _____
SHEET _____ Of _____

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PROBLEM IDENTIFICATION REPORT

Date _____

Day | Su | M | T | W | Th | F | Sa |

Project _____ Job Number _____

Contractor _____

Subject _____

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

PROBLEM DESCRIPTION Reference Daily Report Number 1: _____

PROBLEM LOCATION - REFERENCE TEST RESULTS AND LOCATION (Note: Use sketches on back of form as appropriate):

PROBABLE CAUSES: _____

SUGGESTED CORRECTIVE MEASURES: _____

APPROVALS:

QA ENGINEER: _____

PROJECT MANAGER: _____

Distribution:
1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: _____

MEETINGS HELD AND RESULTS

REMARKS

REFERENCES TO OTHER FORMS

SKETCHES

SAMPLE LOG

SAMPLE NUMBER

APPROXIMATE LOCATION OF STOCKPILE

NUMBER OF STOCKPILE

DATE OF COLLECTION

CLIMATIC CONDITIONS

FIELD OBSERVATION

SHEETS OF

CORRECTIVE MEASURES REPORT

Date _____

Project _____ Job Number _____

Day | Su | M | T | W | Th | F | Sa |

Contractor _____

Subject _____

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

CORRECTIVE MEASURES TAKEN (Reference Problem Identification Report No.): _____

RETESTING LOCATION: _____

SUGGESTED METHOD OF MINIMIZING RE-OCCURRENCE: _____

SUGGESTED CORRECTIVE MEASURES: _____

APPROVALS:

QA ENGINEER: _____

PROJECT MANAGER: _____

Distribution:

1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: _____

Section 5

SAMPLE COLLECTION AND FIELD SCREENING (SC)

SUMMARY GUIDANCE

SC-001 General Guidance on Sample Collection

1. Overview

The primary objective of all sampling activities is to characterize a site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of material under investigation. The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures.

2. Sample Purposes

In relation to the media to be sampled, two basic types of samples can be considered:

2.1. Waste Characterization sample

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, soil, groundwater, soil vapor, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

2.2. Environmental sample

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or the Department of Transportation (DOT) regulations and U.S. Environmental Protection Agency (EPA) guidelines.

3. Sample Collection Techniques

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

3.1. Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

3.2. Composite Samples

Composites are non-discrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits. Compositing of hazardous waste is often performed after compatibility tests have been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

3.3. Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

- Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site.
- Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established.
- When judgmental sampling is performed, samples are collected only from the portions) of the site most likely to be contaminated.

Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

4. Sample Hold Time, Container, and Preservation Methods

The following table provides general required Holding Time, Container, and Preservation Methods. Most of the information is specific to the EPA analytical method and should be pertinent to all sampling schemes. However, some analytical preservation and analytical methods are state specific. The QAPP should clearly identify preservation methods and hold times prior to sampling.

Samples should be submitted to the laboratory as soon as possible. It is preferable to send samples from the field via courier service rather than bringing to the office for later pickup.

Aqueous

Parameter	Holding Time	Container	Volume	Preservative
Acidity	14 days	P, G	100 ml	Cool, 4°C
Alkalinity	14 days	P, G	100 ml	Cool, 4°C
Biological Oxygen Demand (BOD)	48 hours	P, G	1000 ml	Cool, 4°C
Chemical Oxygen Demand (COD)	28 days	P, G	100 ml	Cool, 4°C, H_2SO_4 to pH<2
Chloride	28 days	P, G	100 ml	Cool, 4°C
Chromium, Hexavalent	24 hours	P, G	250 ml	Cool, 4°C
Cyanide				
Amenable	14 days[1]	P, G	500 ml	Cool, 4°C, NaOH to pH>12
Free	14 days[1]	P, G	500 ml	Cool, 4°C, NaOH to pH>12
Total	14 days[1]	P, G	500 ml	Cool, 4°C, NaOH to pH>12
Fluoride	28 days	P	100 ml	Cool, 4°C
Hardness, Total	6 months	P, G	100 ml	HNO_3 to pH<2
Metals (except Cr+6, Hg)	6 months	P	500 ml	Cool, 4°C, HNO_3 to pH<2
MBAS	48 hours	G	500 ml	Cool, 4°C
Mercury	28 days	P, G	500 ml	HNO_3 to pH<2
N, Ammonia	28 days	P, G	100 ml	H_2SO_4 to pH<2
N, T. Kjeldahl	28 days	P, G	500 ml	H_2SO_4 to pH<2
N, Nitrate	48 hrs/ 28 days preserved	P, G	100 ml	Cool, 4°C or add H_2SO_4 to pH<2
N, Nitrite	48 hours	P, G	100 ml	Cool, 4°C
Oil and Grease	28 days	G	1000 ml	Cool, 4°C, H_2SO_4 or HCl to pH<2
Petroleum Hydrocarbons	14 days	G	1000 ml	Cool, 4°C, H_2SO_4 to pH<2
pH	Analyze Immediately	P, G	50 ml	N/A
Phenols,Recoverable	28 days	G	500 ml	Cool, 4°C, H_2SO_4 to pH<2
Phosphorus, Ortho	48 hours	P, G	100 ml	Filter, Cool, 4°C
Phosphorus, Total	28 days	P, G	100 ml	Cool, 4°C, H_2SO_4 to pH<2
Radiological Tests				
Alpha, Beta & Radium	6 months	P, G	4 L	Cool, 4°C, HNO_3 to pH<2
Solids, Total	7 days	P, G	100 ml	Cool, 4°C

Aqueous (cont)

Parameter	Holding Time	Container	Volume	Preservative
Solids, Total Dissolved	7 days	P, G	100 ml	Cool, 4°C
Solids, Total Suspended	7 days	P, G	100 ml	Cool, 4°C
Solids, Volatile Suspended	7 days	P, G	100 ml	Cool, 4°C
Sulfate	28 days	P, G	100 ml	Cool, 4°C
Total Organic Carbon	28 days	P, G	100 ml	Cool, 4°C, H_2SO_4 to pH<2
Halogenated Volatiles	14 days	40 ml vials	2x40 ml	Cool, 4°C3
Purgeable Aromatics	14 days[4]	40 ml vials	2x40 ml	Cool, 4°C, HCl to pH<2
Phenols by GC/MS	7 days/40 days[5]	G	1 L	Cool, 4°C
Pesticides/PCBs	7 days/40 days[5]	G	1 L	Cool, 4°C
Polynuclear Aromatics	7 days/40 days[5]	G	1 L	Cool, 4°C
Acid/Base-Neutral Extractables	7 days/40 days[5]	G	1 L	Cool, 4°C

Solid

Parameter	Holding Time	Container	Volume	Preservative
Metals (except Hg)	6 months	P, G	100 g	Cool, 4°C
Mercury	28 days	P, G	100 g	Cool, 4°C
Halogenated Volatile Organics	14 days	G	10 g/10 ml methanol, 10 g/10 Ml DI water	Methanol and deionized water preserved in field[6]
Halogenated Volatile Organics	14 days	Encore Samplers	Three 5 gram samples	Must be frozen within 48 hours
Purgeable Aromatics	14 days	G	10 g/10 ml methanol, 10 g/10 Ml DI water	Methanol and deionized water preserved in field[6]
Phenols	14 days/40 days[5]	G	100 g	Cool, 4°C
Pesticides/PCBs	14 days/40 days[5]	G	100 g	Cool, 4°C
Polynuclear Aromatics	14 days/40 days[5]	G	100 g	Cool, 4°C
Acid/Base-Neutral Extractables	14 days/40 days[5]	G	100 g	Cool, 4°C

NOTES:
P = Plastic
G = Glass

Holding times in red indicate 48 hours or less holding times.

1. If residual chlorine is present, add 0.6 gm. ascorbic acid.

2. Maximum holding time is 24 hours when sulfide is present. Test with lead acetate paper prior to pH adjustment. Remove sulfide with addition of lead nitrate until a negative spot test is obtained. Filter and add NaOH to pH>12.

3. If samples contain residual chlorine, add 0.008% sodium thiosulfate at the time of sampling.

4. With pH adjustment; without, holding time is 7 days.

5. Seven days prior to extraction. Samples must be analyzed within 40 days after extraction.

6. Encore samplers may be used, but must be received in lab and extracted within 48 hours.

5. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

Analytical Service Protocol, New York State Department of Environmental Conservation. July 2005.

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory.

Determination of Volatile Organic Compounds, Version 2.0 February 28, 2006.

STANDARD OPERATING PROCEDURE

SC-002 Sample Handling

1. Objective

Sample handling involves the collection and shipping of environmental samples to a laboratory for chemical analysis. The overall objective of sample handling is to ensure that samples are properly:

- labeled and documented;
- preserved;
- packaged; and
- transported to laboratories.

2. Execution

- Prior to mobilizing to the field, select a shipper or arrange for a courier for sample delivery to the laboratory. If using a shipper (i.e., FedEx, or UPS) determine the time constraints for pickup requests, the location and hours of the nearest shipping office, and any size/weight restrictions.
- Label all laboratory glassware with waterproof ink prior to collecting the respective samples. The label should have an adhesive and be placed on the jar or bottle, not on the cap.
- Record the following information on the label and in the field notebook (see *Field Notebook* SOP FD-001): project number, sample identification (i.e., MW201 or SS-2), date, and time (military time) of collection, sampler's initials, and preservative, if present.
- If sample jars are not pre-preserved, add preservative as appropriate.
- At each sampling location, samples must be collected in order of volatility, most volatile first. Samples collected for volatile analysis must be placed in sample containers immediately upon retrieval of the sample.
- Aqueous samples for volatile analysis must be collected without air bubbles. Soil samples for volatile analysis should be compacted to eliminate as much headspace as possible. Other laboratory glassware should also be filled when possible. Care must be taken to avoid getting soils on the threads of sample jars, which can cause a faulty seal.
- If compositing of samples is performed in the field, specify basis for composite (i.e., volume, weight, spoon recovery, etc.) and record procedure for compositing sample in the field book.
- Once samples have been collected, place samples in a cooler with ice or a blue pack and start the chain of custody (COC) form (SOP FD-003, *Sample Handling and Chain of Custody*).

- For shipping, individually wrap each sample bottle with bubble packing or suitable packing material and place the wrapped bottles in the cooler with sufficient packing material between samples to avoid breakage.
- Place a layer of packing material above and below the sample bottles. Place blue ice packs or ice bags on top of the packing material. Fill the remaining space in the cooler with packing material to eliminate the possibility of vertical movement of samples.
- Place the completed and signed COC form in a plastic bag and place on top of the packing material in the cooler.
- Fill out the appropriate shipping or courier forms and attach to the top of the cooler. If necessary, place the proper shipping labels on the cooler. Have the courier sign the COC form (or write pickup by FedEx, UPS, etc., with date and time). Place a custody seal on the cooler.
- All samples should be submitted as soon as possible. It is preferable for samples to be mailed prior to returning to the office.
- A copy of the waybills must be kept by the field supervisor to track shipments if necessary.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Work Plan and Health and Safety Plan.
- Field personnel must be aware of analyses which have short holding times and schedule sampling events and shipping accordingly. Shipment of samples for analyses with short holding times must be planned in advance. Refer to the project work plan, quality assurance project plan, or state/federal regulations for holding time and preservative information.
- In general, glassware for aqueous samples contains preservatives, (i.e., HNO3, HCl, etc). When collecting the sample, take care not to overfill the container, thus flushing the preservative out of the bottle.
- Never composite samples for volatile organic compounds (VOCs) in the field. Collect individual aliquots and direct the laboratory to perform compositing.
- Collection of aqueous samples should not be performed over the opening of a monitoring well. Preservatives from overfilling or a marker pen or other objects could fall into the well.
- If the recharge volume for a monitoring well is low, completely fill all volatile vials and then collect the minimum sample volume required for each remaining analysis.
- During subsurface soil sampling, if the recovery from the split-spoon sample is inadequate, if appropriate, resample the bottom of the borehole to obtain proper sample volume.

- Laboratories will homogenize and test the contents of the sample container, unless directed otherwise. Samples should not contain rocks, twigs, leaves, etc., unless these materials are of interest.

4. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

Analytical Service Protocol, New York State Department of Environmental Conservation. July 2005.

New Jersey Department of Environmental Protection, Field Sampling Procedures Manual, August 2005.

Connecticut Department of Environmental Protection, Guidance for Collecting and Preserving Soil and Sediment Samples for Laboratory.

Determination of Volatile Organic Compounds, Version 2.0 February 28, 2006.

5. Attachments

Attachment A – General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

Attachment A

Table 2. General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

[✔, generally appropriate for use shown; Si, silica; Cr, chromium; Ni, nickel; Fe, iron; Mn, manganese; Mo, molybdenum; CFC, chlorofluorocarbon; B, boron]

Construction material for sampling equipment		Target analyte(s)	
Material	**Description**	**Inorganic**	**Organic**
		Plastics[1]	
Fluorocarbon ploymers[2] (other varies available for differing applications)	Chemically inert for most analytes	✔ (potential source of fluoride)	✔ (Sorption of some organics)
Polypropylene	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polypropylene (linear)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polyvinyl chloride (PVC)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Silicone	Very porous. Relatively inert for most inorganic analytes	✔ (potential source of Si)	**Do not use**
		Metals	
Stainless steel 316 (SS 316)	SS-316-metal having the greatest corrosion resistance. Comes in various grades. Used for submersible pump casing.	✔ (Potential source of Cr, Ni, Fe, and possible Mn and Mo) **Do not use** for surface water unless encasted in plastic.	✔ Do not use if corroded[3]
Stainless steel 304	Similar to SS-316, but less corrosion resistant	**Do not use**	✔ Do not use if corroded[3]
Other metals: brass, iron, copper, aluminum, galvanized and carbon steels	Refrigeration-grade copper or aluminum tubing are used routinely for collection of CFC samples	**Do not use**	✔ Routinely used for CFCs Do not use if corroded[3]
		Glass	
Glass, borosilicate (laboratory grade)	Relatively inert. Potential sorption of analytes	✔ **Do not use** for trace element analyses. Potential source of B and Si	✔

[1]Plastic used in connection with inorganic trace-element sampling should be uncolored or white. Tubing used for trace metal sampling should be cleaned by soaking in 5-10 percent HCl solution for 8-24 hours, rinsing with reagent water (metals free) and allowed to air dry in mercury-free environment. After drying, the tubing is doubled-bagged in clear polyethylene bags, serialized with a unique number, and stored until used.

[2] Fluorocarbon polymers include materials such as Teflon™, Kynar™, and Tefzel™ that are relatively inert for sampling inorganic or organic analytes. Only fluoropolymer should be used for samples that will analyzed for mercury because mercury vapors can diffuse in or out of other materials, resulting in either contaminated or biased results.

[3] Corroded/weathered surfaces are active sorption sites for organic compounds.

STANDARD OPERATING PROCEDURE

SC-003 Investigation Derived Waste

1. Objective

The objective is to provide guidelines for the proper management of Investigation Derived Waste (IDW) resulting from site investigation activities. This Standard Operating Procedure (SOP) addresses IDW generated during field tasks typically performed for environmental site investigations. The intent of this SOP is to provide a set of guidelines for proper assessment and handling of these IDWs.

2. Execution

- Determine the suspected contamination type and impacted media anticipated based on previous investigations, current analytical data, and/or site history.
- Consider the following issues when selecting IDW management option(s):
    i. anticipated volume of IDW to be generated during on-site activities
    ii. potential contaminants and their concentrations
    iii. location of the nearest populations and the likelihood and/or degree of site access
    iv. potential exposures to workers
    v. potential for environmental impacts
    vi. community concerns
    vii. potential storage areas
    viii. regulatory constraints
    ix. potential on-site treatment options
- Select IDW Management Option(s) prior to the commencement of field activities that will generate waste materials.
- In addition to the issues considered above for the selection of IDW management strategies/disposal options, more specific considerations/guidelines include:

2.1. Test Pit Excavation

- Segregate contaminated soil from uncontaminated soil using visual and/or field screening methods.
- Use appropriate barrier (plastic sheeting) for temporary stockpiling of contaminated soil adjacent to test pit.
- Backfill test pits with uncontaminated soil.
- For situations where returning contaminated soil to the test pit is deemed protective by the project manager, backfill soil in the same order as the soil was excavated from the test pit.

- For contaminated soil pile, collect representative sample(s) for test pit(s) for waste disposal characterization
- Ensure that the pile is appropriately covered with polysheeting and secured until disposed offsite.

2.2. Boring/Monitoring Well Installation

- For auger borings, segregate contaminated soil (determined by visual and/or field screening methods) from uncontaminated soil during drilling. Segregate residual contaminated soil from split-spoon sampling.
- Auger cuttings or sediment generated by drive and wash may be spread around the ground surface at the boring location if deemed appropriate by the project manager. IDW may be placed in an appropriate area or container pending characterization and appropriate disposal. (A useful rule of thumb is to assume generation of one 55-gallon drum of cuttings for each 20 feet drilled with 7-¼-inch-inner diameter [ID] augers).
- Segregate contaminated drilling fluid from uncontaminated fluid for rotary wash borings.
- Drilling fluid management options include pouring the drilling fluid on the ground in the Area of Concern (AOC) or containerizing the fluid in drums or tanks.

2.3. Water Development/Sampling

- Contaminated groundwater removed from wells by pumping or bailing for the purpose of well development and sampling should be containerized at the project manager's discretion.

2.4. Decontamination Fluids

- Decontamination fluids should be containerized in drums or tanks.

2.5. Disposable Personal Protective Equipment (PPE)

- Disposable PPE must be managed like any other IDW. It should only be removed from the site with the project manager's approval, and may be disposed of as ordinary rubbish only if it has not come into contact with hazardous materials.

3. Notes

- The preferred IDW management option is to return the IDW to its source. However, this is not always an option.
- The IDW selected must be in accordance with state/federal regulations.

- National Grid contracts directly with the transportation and disposal contractor for the disposal of IDW, should disposal be necessary.

4. References

Guide to Management of Investigation - Derived Wastes (April 1992), United States Environmental Protection Agency, Publication 9345.3-03FS.

Standard References for Monitoring Wells, Massachusetts Department of Environmental Protection, Publication No. WSC-310-91.

Connecticut Department of Environmental Protection Connecticut's RCRA "Contained-In" Policy, Updated June 2005

STANDARD OPERATING PROCEDURE

SC-004 Head Space VOC Screening

1. Objective

To obtain a site-specific indication of the volatile organic compounds (VOC) concentrations present in soil. This information can be used: 1) to segregate soil based on degree of contamination, 2) to identify samples for quantitative analysis of VOCs, or 3) as a qualitative method to evaluate the presence or absence of VOCs in soil.

2. Execution

- A photoionization detector (PID) or flame ionization detector (FID) instrument is used to measure VOCs in jar head space (JHS) screening. Select the appropriate instrument, lamp, and calibration gas for the site-specific contaminants. Calibrate the instrument in accordance with the manufacturer's instructions before JHS screening begins. Record the type of calibration gas, detector, and lamp in the field notebook.
- Note the highest VOC concentration that the instrument measures in air in the work area before performing JHS screening. Record this as the initial background concentration.
- Half-fill a clean, glass jar with the soil. Use a clean trowel or soil spatula. Quickly cover the open top with one or two sheets of clean, aluminum foil and screw on the cap to tightly seal the jar. Label the sample location and depth from which the sample was collected on the jar.
- Allow headspace development for at least 10 minutes at an ambient temperature of 50°F or greater. Vigorously shake the jar for 15 seconds at the beginning and end of the headspace development period. When ambient temperatures are below 50°F, place the jar in a heated van or building during the headspace development period.
- After headspace development, remove the screw cap to expose the foil seal. Quickly puncture the foil seal with the instrument's sampling probe and insert it to a point at about one-half of the headspace depth.
- Record the highest VOC concentration that the instrument displays as the JHS concentration. The highest concentration should occur between 2 and 5 seconds after probe insertion.

3. Notes

- The instruments may work poorly in the rain and in freezing temperatures. PIDs may not function in high-humidity conditions. Under such conditions, operate the instrument in a heated vehicle or building.

- Prevent water and soil particles from entering the tip of the instrument probe. Use a filter on the instrument's probe.
- Measure background VOC conditions and perform JHS screening away from non-site-related VOC sources, such as vehicle and heavy equipment exhaust.
- The VOC concentration on the instrument's display may vary when the air contains high VOC concentrations or high moisture.
- JHS screening is a guide that helps the screener to segregate soils into broadly defined categories. JHS screening results may differ by orders of magnitude from laboratory testing results.

4. References

Interim Remediation Waste Management Policy for Petroleum Contaminated Soils. (April 1994), Massachusetts Department of Environmental Protection, Policy #WSC-94-400.

STANDARD OPERATING PROCEDURE

SC-005 SiteLAB™ UVF-3100 Ultraviolet Fluorescence (UVF) detection method

1. Objective

To establish standard procedures for the field analysis of petroleum hydrocarbons in soil and water using the SiteLAB™ UVF-3100 Ultraviolet Fluorescence (UVF) detection method.

Ultraviolet Fluorescence is a very selective detection method useful for testing many types of environmental contaminants. The principle of operation relies on the electronic configuration of the molecular structure for each contaminant. When a hydrocarbon molecule is exposed to certain wavelengths of light, the molecule emits energy at a specific wavelength. The light energy emitted by an environmental sample exposed to a UV source is directly proportional to the concentration of hydrocarbons present. The fluorescence response of each sample is then quantified using a 5 point linear calibration curve. A specific range of target compounds can be quantified by first selecting the appropriate wavelengths of light to be detected by the UVF-3100 and then using certified standards sensitive to the wavelengths of interest, to establish the linear range of the calibration curve. The UVF-3100 can be calibrated to detect the following types of hydrocarbon ranges:

- Volatile Petroleum Hydrocarbons (C9-C10 molecular weights) including benzene, toluene ethylbenzene and xylene (BTEX).
- Gasoline Range Organics (C5-C10) including BTEX.
- Extractable Petroleum Hydrocarbons (C11-C22).
- Extractable Diesel Range Organics (C10-C40) (weathered Diesel).
- Polycyclic Aromatic Hydrocarbons (PAH Mix).
- #2 Fuel Oil.
- #6 Fuel Oil.
- Motor Oil Range Organics.
- Polychlorinated Biphenyls (PCBs).

After calibrating the instrument and performing the sample extraction step, the UVF-3100's actual analysis time is less than 5 seconds.

2. Execution

- On receipt of the instrument, inspect all shipping cartons to ensure that all components have been received and verify that the unit is operational.
- On site, assemble the unit according to the manufacturer’s instructions. Install the UVF-3100 software onto the field notebook computer.

- The UVF-3100 is equipped with an internal battery. However, the AC adapter may be needed for extended operation. Be prepared to switch to AC power if necessary.
- Operate the UVF-3100 for 20 minutes prior to use to ensure that the instrument is operating at full performance.
- Select the applicable standards based on the target hydrocarbon range (i.e., BTEX, PAHs, etc.).
- Calibrate the UVF-3100 in accordance with the instructions provided with the appropriate calibration kit. PROPER CALIBRATION OF THE INSTRUMENT IS CRITICAL.
- For optimal use of the UVF-3100, approximately 20 samples (maximum of 20 samples) should be screened during each run.
- Extract samples using the SiteLAB™ UVF Analytical Test Kit (Product Number EXTR010-20).
- Sample extracts can be stored for up to three months if kept refrigerated.
- Field personnel should be familiar with both the sample extraction and the calibration procedure before attempting to record data.
- Operate instrument as per manufacturer's instructions.
    1. Select the appropriate optical filter for the specific test to be run.
    2. Select the proper wavelength for the specific test to be run.
    3. Perform the 5-point calibration using the appropriate standards.
    4. Perform the sample extraction procedure.
    5. Make any necessary dilutions.
    6. Analyze the samples and record the results on the record sheet included with the extraction kit. Include test run number, Sample ID, Fluorescence, Sample Concentration, and Dilution Factor on the sheet.
    7. Calculate result by multiplying the sample result by the dilution factor.
    8. Repeat for each sample. Make addition dilutions if necessary.
- **Sample dilution** – Samples exhibiting a yellowish color should be diluted until a minimal yellow tint is observed. Analyze both the diluted sample and the undiluted sample for comparison. Follow dilution procedure outlined in the manual. Addition methanol may be necessary for further dilution.
- **Field duplicate** – a duplicate sample should be collected from a sample location suspected of being contaminated with the target hydrocarbon and extracted in a manner identical to the original sample.

Field duplicates should be taken at a frequency of one per twenty samples or one per weekly sampling whichever is the greater.

3. References

Interim Remediation Waste Management Policy for Petroleum Contaminated Soils. (April 1994), Massachusetts Department of Environmental Protection, Policy #WSC-94-400.

Innovative Technology Verification Report, Field Measurement Technologies for Total Petroleum Hydrocarbons in Soil United States Office of Research and EPA/600/R-01/080.

Environmental Protection Development September 2001, Agency Washington, DC 20460
siteLAB® Corporation, siteLAB® Analytical Test Kit UVF-3100A.

Section 6

SOLID MATRIX SAMPLING (SM)

STANDARD OPERATING PROCEDURE

SM-001 Soil Sampling Techniques Including Split-Spoon

1. Objective

This Standard Operating Procedure (SOP) is used primarily to collect surface, shallow subsurface, and stockpile soil samples. Surface soils are generally classified as soils between the ground surface and 6 to 12 inches below ground surface (bgs). The shallow subsurface interval may be considered to extend from approximately 12 inches bgs to a site-specific depth at which sample collection using manual methods becomes impractical.

2. Execution

2.1. At-Depth Sampling

When sampling at depth, utilize the procedures outlined in the following SOPs for the drilling method used:

Hollow Stem Auger (split spoon): SOP DM-002
Sonic Drilling: SOP DM-003
Geoprobe or Direct Push (macrocore): SOP DM-005

2.2. Surface Soil Sampling

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample. This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required.

- Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
- Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
- If volatile organic analysis is to be performed, transfer the sample directly into an appropriate labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly.
- Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

- Either place the sample into appropriate labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly.
- When compositing is complete, place the sample into appropriate labeled containers and secure the caps tightly.
- Label, preserve, and store the sample in accordance with SOP SC-002 *Sample Handling*.

2.3. Stockpile Sampling

- Collection of samples from stockpiles can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material from the stockpile is removed and a stainless steel or plastic scoop is then used to collect the sample.
- Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
- If volatile organic analysis is to be performed, transfer the sample directly into an appropriate labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly.
- Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling stockpile.
- When collecting composite samples, place a sample from another sampling location into the homogenization container and mix thoroughly.
- When compositing is complete, place the sample into appropriate labeled containers and secure the caps tightly.
- Label, preserve, and store the sample in accordance with SOP SC-002 *Sample Handling*.

3. References

ASTM D1585-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils". 1998.

United States Environmental Protection Agency, SOP 2012 "Soil Sampling", Revision 0.0, February 18, 2000.

STANDARD OPERATING PROCEDURE

SM-002 VOC Soil Collection and Preservation Method (if necessary)

1. Objective

To establish a standard for preserving soil samples for analysis of Volatile Organic Compounds (VOCs).

2. Execution

The soil sample collection procedure for determination of VOCs is a two-step process.

- Step 1 – Collect an undisturbed soil sample from the subsurface, or expose the targeted area from where a sub-sample for lab analysis will be collected.
- Step 2 – Collect a representative sub-sample from the undisturbed sample or directly from the exposed surface.

If samples are to be analyzed for VOCs, they should be collected in a manner that minimizes disturbance of the sample. Samples for VOC analysis are not homogenized. Preservatives may be required for some samples with certain variations of Method 5035. Consult the method or the principal analytical chemist to determine if preservatives are necessary.

When the soil sample is collected for VOC analysis, it must be placed within the laboratory container immediately. It must not be allowed to sit exposed for more than 5 minutes. In addition, the sample must not be exposed to extreme weather conditions (i.e., rain, extreme sunlight, wind, etc.).

Sub-samples are a portion of the undisturbed sample that will be sent to the lab for VOC analysis. Sub-samples must be obtained utilizing a small diameter core sampler. Some of the acceptable small diameter core samplers include: a 10 milliliter (ml) plastic disposable syringe, a Purge and Trap Soil Sampler, En Core Samplers, or an Easy Draw Syringe. The En Core Sampler is the only small diameter core sampler that can be used to collect the sample, store the sample, and transport the sample to the lab.

The procedure for the collection of sub-samples is as follows:

- Once the sampling interval has been selected, trim off the exposed surface of the matrix, with a decontaminated trowel or spatula, to expose a fresh surface. Then sample immediately.
- Push the En Core sampler into the matrix to collect a volume of material that will yield the required mass of sample (wet weight) as determined by the analytical method.

- Push the En Core sampler into the material at an angle as many times as is needed to obtain the required sample weight.
- Wipe the exterior of the sampler clean.
- Seal the En Core sampler as explained in the manufacturer's instructions.
- Collect the required number of En Core samplers based on the chosen preservation and analytical methods, as discussed in the section on soil preservation methods below.
- Collect a separate sample for head space screening and moisture content determination.
- Make sure that the threads of the En Core sampler are free of particles (by cleaning with a paper towel).
- Mark the samplers with a permanent marker and not an adhesive label (due to weight considerations).
- Once the samples have been collected, sealed, and labeled, place the samples into an iced cooler. It is recommended to place each sample container in separate zip lock bag.

If collecting VOC soil samples during drilling, please refer to SM-001: *Soil Sampling Techniques Including Split-Spoon* for detailed information.

2.1. Preservation of Soil Samples

When collecting soil samples for determination of VOCs, three types of samples may be required:

- High concentration sample (Section 2.2 below).
- Low concentration sample (Section 2.3 below).
- Synthetic Precipitation Leaching Procedure/Toxicity Characteristic Leaching Procedure (SPLP/TCLP) sample (Section 2.4 below).

2.2. Two options for the collection of a suspected "high" concentration sample

- Collect one 10 gram sample in a pre-weighted vial containing 10 ml methanol.
- Use an "En Core" sampler.

2.2.1. Option 1 – Methanol Preservation Method

Supplies include: two pre-weighed vials (per sample) with 10 ml methanol, and a sampling device to collect a 10 gram sample.

Sampling Procedure:

- Label vials using permanent marker.
- Scrape away surface to be sampled to expose fresh soil.

- Collect the sample using the sampling device and extrude the sample into the preserved vial. Wipe the threads and cap clean and seal the vial.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.

2.2.2. Option 2 – En Core Sampling Method

Supplies needed: One 5 or 10 ml En Core sampler.

Sampling Procedure:

- Label the En Core sampling container.
- Locate the sampling area, scrape a fresh face, collect the sample quickly, and clean and seal the sampler.
- Place sampler in a clean zip lock bag and place on ice.
- Collect separate samples in separate containers for percent solids and head space sampling.
- Samples must be frozen, or preserved, or analyzed within 48 hours (coordinated with the lab).

Option 2 (En Core Sampler) is preferred due to possible problems with minimum detection levels when using the methanol method.

2.3. Four different options for the collection of "low" concentration samples for VOC analysis

- Collect two vials each of 5 grams of sample into a pre-weighted 40 ml vial with 5 ml of water and a magnetic stirrer.
- Collect two vials each of 5 grams of sample into a pre-weighted 40 ml vial with a magnetic stirrer.
- Collect two 5 gram En-Core type samples.
- Collect two vials each of 5 grams of sample into a pre-weighted vial containing sodium bisulfate with a magnetic stirrer.

2.3.1. Option 1 – Collection in Volatile Organic Compound (VOC) vials containing water

Supplies required: an electronic field balance, two VOC 40 ml vials pre-weighted and containing 5 ml of water, a magnetic stirrer, and a sampling device.

Sampling procedure:

- Label vials using permanent marker.
- Select the area to be sampled.
- Test sample and weigh to verify the amount of sample needed.
- Scrape a clean surface to be sampled.

- Collect the sample using the sampling device and extrude the sample into one of the two vials containing water. Wipe the threads and cap clean and seal the vial.
- Repeat the last step for the second vial.
- Weigh the vials and record the weights.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.

2.3.2. Option 2 – Collection in empty VOC vials

Supplies required: electronic field balance, two VOC 40 ml vials pre-weighted, a magnetic stirrer, and a sampling device.

Sampling Procedure:

- Label vials using permanent marker.
- Select the area to be sampled.
- Test sample and weigh to verify the amount of sample needed.
- Scrape a clean surface to be sampled.
- Collect the sample using the sampling device and extrude the sample into the vial. Wipe the threads and cap clean and seal the vial.
- Repeat the last step for the second vial.
- Weigh the vials and record the weights.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.
- Samples must be frozen or analyzed within 48 hours.

2.3.3. Option 3 – Collection in VOC vials preserved with Sodium Bisulfate

Supplies required: electronic field balance, two VOC vials with 5 ml of sodium bisulfate, a magnetic stir bar, and a sampling device.

Sampling Procedure:

- Label vials using permanent marker.
- Select the area to be sampled.
- Test sample and weigh to verify the amount of sample needed.
- Scrape a clean surface to be sampled.
- Collect the sample using the sampling device and extrude a 5 gram sample into the vial containing the sodium bisulfate. Wipe treads and cap and seal the vial.
- Repeat the last two steps for the second vial.
- Weigh the vial and record the weight.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.

2.3.4. Option 4 – Collection of the sample with an En Core Sampler

Supplies required: two 5 gram En Core samplers.

Sampling Procedure:

- Label samplers using permanent marker.
- Select the area to be sampled.
- Scrape a clean surface to be sampled.
- Collect the sample using one En Core devise, wipe the contact areas clean and seal, and place into a re-sealable zip lock bag.
- Repeat the last two steps with the second En Core device.
- Store the sample in an iced cooler.
- Collect a separate sample for percent solids and head space sampling.
- Samples must be frozen or analyzed within 48 hours.

2.4. Collection of samples being analyzed for VOCs by the TCLP or SPLP method

Supplies required: a 25 gram En Core Sampler.

Sampling Procedure

- Label sampler using permanent marker.
- Select the area to be sampled.
- Scrape a fresh surface to be sampled.
- Collect the sample using one En Core devise, wipe the contact areas clean and seal, and place into a re-sealable zip lock bag.
- Store the sample in an iced cooler.
- Samples must be frozen or analyzed within 48 hours.

To determine percent solids, approximately 20 grams of soil sample must be collected in a separate glass or plastic sampling container. The percent solids sample is **NOT** to be taken from the VOC samples.

3. Holding Times

- Field investigators should note that the holding time for an un-preserved VOC soil/sediment sample is 48 hours. Arrangements should be made to ship the soil/sediment VOC samples to the laboratory by overnight delivery the day they are collected so the laboratory may preserve and/or analyze the sample within 48 hours of collection.

STANDARD OPERATING PROCEDURE

SM-003 Soil Classification

1. Objective

To describe and classify soil samples collected in the field in a consistent and useful manner. GEI has adopted the (ASTM) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) D2488..

2. Execution

- Describe soil samples according to the ASTM Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) D2488 (see Attachment A – Visual Manual Descriptions).
- Identify and record the soil in terms of the major and minor constituents (i.e., sand gravel, silt, clay), group symbol, group name, sample structure, plasticity and dilatancy for fine-grained soils, color, local or geologic name if known (e.g., glacial till), odor, presence of iron or other staining, and presence of organic matter, shells, debris, or other unusual characteristics of the same.
- If a soil split-spoon sample contains more than one soil type (for example, the upper portion is silty sand and the lower portion is clay) describe each type separately, and obtain separate jars of each type.
- Record sampler type, blow counts, soil description, etc., on the boring log.
- One modification to the ASTM standard: Use "widely graded" and "narrowly graded" instead of "well-graded" and "poorly graded."
- Based on the percent volume, the following descriptions should be used:
    1. “and” = 35-50%
    2. “some” = 20-35%
    3. “little” = 10-20%
    4. “trace” = 1-10%

3. Notes

- Some soil characteristics, such as plasticity and dilatancy, are difficult to identify in the field during extremely cold or wet weather. The field classification should be verified in the office after the samples have returned to room temperature if samples were collected during extreme weather conditions.

- The ASTM Standard Test Method for Classification Soils for Engineering Purposes, D2487 may be used in conjunction with the Visual-Manual Method to confirm the soil classification.

4. References

Annual Book of ASTM Standards (1993), Section 4, v. 4.08 Soil and Rock; Building Stones; Geosynthetics, D2488-90, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), American Society of Testing Materials (ASTM).

5. Attachments

Attachment A – Visual Manual Descriptions with example boring log

Attachment A

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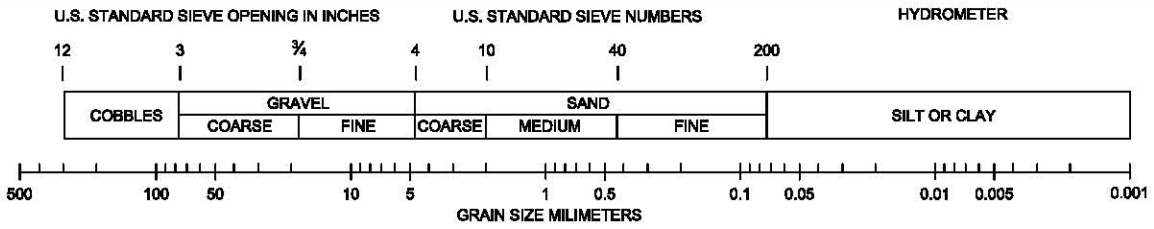
COARSE-GRAINED SOILS

VISUAL-MANUAL DESCRIPTIONS

TYPICAL SOIL COLORS

- YELLOW
- OLIVE
- LIGHT BROWN
- BROWN
- REDDISH BROWN
- RED
- GRAY
- BLACK

				GROUP SYMBOL	GROUP NAME
GRAVEL % Gravel > % Sand	≤5% Fines	WIDELY GRADED		GW	<15% Sand → WIDELY GRADED GRAVEL
					≥15% Sand → WIDELY GRADED GRAVEL WITH SAND
		NARROWLY GRADED		GP	<15% Sand → NARROWLY GRADED GRAVEL
					≥15% Sand → NARROWLY GRADED GRAVEL WITH SAND
	~10% Fines	WIDELY GRADED	Fines = ML or MH	GW-GM	<15% Sand → WIDELY GRADED GRAVEL WITH SILT
					≥15% Sand → WIDELY GRADED GRAVEL WITH SILT AND SAND
			Fines = CL or CH	GW-GC	<15% Sand → WIDELY GRADED GRAVEL WITH CLAY
					≥15% Sand → WIDELY GRADED GRAVEL WITH CLAY AND SAND
		NARROWLY GRADED	Fines = ML or MH	GP-GM	<15% Sand → NARROWLY GRADED GRAVEL WITH SILT
					≥15% Sand → NARROWLY GRADED GRAVEL WITH SILT AND SAND
			Fines = CL or CH	GP-GC	<15% Sand → NARROWLY GRADED GRAVEL WITH CLAY
					≥15% Sand → NARROWLY GRADED GRAVEL WITH CLAY AND SAND
	≥15% Fines		Fines = ML or MH	GM	<15% Sand → SILTY GRAVEL
					≥15% Sand → SILTY GRAVEL WITH SAND
			Fines = CL or CH	GC	<15% Sand → CLAYEY GRAVEL
					≥15% Sand → CLAYEY GRAVEL WITH SAND
SOILS WITH <50% FINES					
SAND % Sand ≥ % Gravel	≤5% Fines	WIDELY GRADED		SW	<15% Gravel → WIDELY GRADED SAND
					≥15% Gravel → WIDELY GRADED SAND WITH GRAVEL
		NARROWLY GRADED		SP	<15% Gravel → NARROWLY GRADED SAND
					≥15% Gravel → NARROWLY GRADED SAND WITH GRAVEL
	~10% Fines	WIDELY GRADED	Fines = ML or MH	SW-SM	<15% Gravel → WIDELY GRADED SAND WITH SILT
					≥15% Gravel → WIDELY GRADED SAND WITH SILT AND GRAVEL
			Fines = CL or CH	SW-SC	<15% Gravel → WIDELY GRADED SAND WITH CLAY
					≥15% Gravel → WIDELY GRADED SAND WITH CLAY AND GRAVEL
		NARROWLY GRADED	Fines = ML or MH	SP-SM	<15% Gravel → NARROWLY GRADED SAND WITH SILT
					≥15% Gravel → NARROWLY GRADED SAND WITH SILT AND GRAVEL
			Fines = CL or CH	SP-SC	<15% Gravel → NARROWLY GRADED SAND WITH CLAY
					≥15% Gravel → NARROWLY GRADED SAND WITH CLAY AND GRAVEL
	≥15% Fines		Fines = ML or MH	SM	<15% Gravel → SILTY SAND
					≥15% Gravel → SILTY SAND WITH GRAVEL
			Fines = CL or CH	SC	<15% Gravel → CLAYEY SAND
					≥15% Gravel → CLAYEY SAND WITH GRAVEL



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

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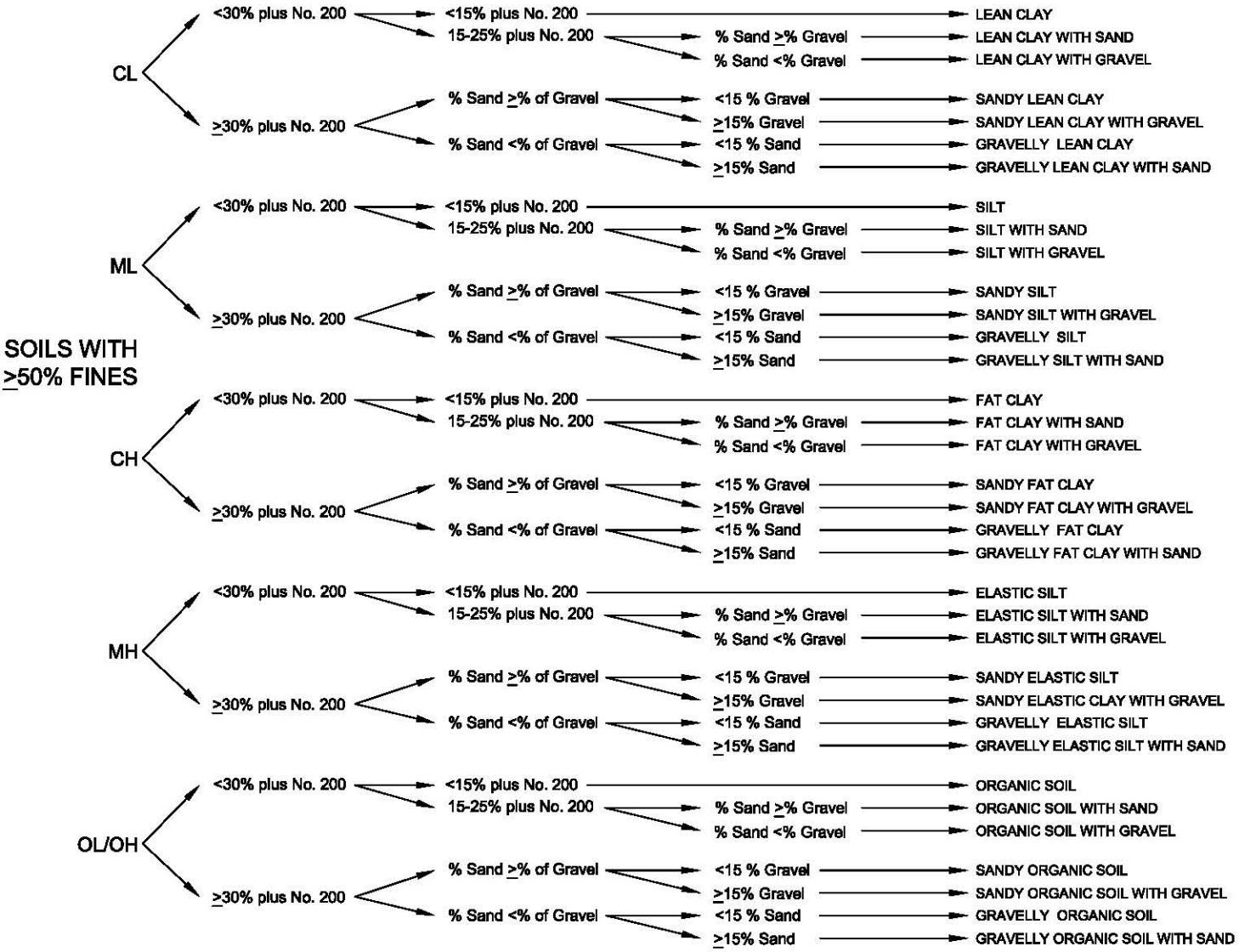
FINE-GRAINED SOILS
VISUAL-MANUAL DESCRIPTIONS



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.

BORING LOCATION Maple Ave Sidewalk
GROUND ELEVATION (NGVD) _____
GROUNDWATER EL. _____ DATE _____

DATE START/FINISH 2/14/07 - 2/15/07
DRILLED BY Geologic: M. Costigan
LOGGED BY T. Kahl/M. Yako TOTAL DEPTH (FT) 25

B101

PG. 1 OF 1

EL. FT.	DEPTH FT.	SAMPLE TYPE and NO.	SAMPLE BLOWS PER 6 IN.	SAMPLE PEN IN.	SAMPLE REC IN.	PID JAR HS / REMARKS	GRAPHIC LOG	SOIL AND ROCK DESCRIPTIONS
	0							4" pavement
		S1	13-9 17-14	24	0	0.5 ppm	FILL	S1: Redrove 0.5 to 3.5 ft. Recovery 11": WIDELY GRADED SAND (SW) ~85% sand, ~10% gravel to 1", <5% nonplastic fines, brown. Contains brick fragments and ash. Fill.
	2.5					hard drilling 3 to 4 ft, possible boulder		
	5	S2	7-7 11-13	24	8	2.0 ppm		S2: NARROWLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) ~65% mostly fine sand, ~25% gravel to 3/4 inch ~10% non-plastic fines, brown. Fill.
	7.5	S3	9-10 2-1	24	16	0.0 ppm		S3 (0-10"): Similar to S2.
	10						ORGANICS	S3 (10"-16"): ORGANIC SILT (OL) ~100% slightly plastic fines, dark gray, organic odor, contains white shell fragments.
	12.5	S4	WOH 1-2 1	24	15	0.0 ppm		
	15					hard drilling at 15.5 ft		S4: Similar to S3, bot 6".
	17.5	S5	20-35 50/3"	15	8	Top of rock ~19 ft. Roller bit to 20 ft.	TILL	S5: SILTY SAND WITH GRAVEL (SM) ~60% mostly fine sand, ~25% slightly plastic fines, ~15% gravel to 1/2 inch, olive. Glacial Till.
	20							
	22.5	C1	RQD 70%	60	54	lost ~10 gallons drill fluid from 23 to 25 ft	ROCK	C1: SCHIST, hard, slight weathering at joint surfaces, joints at ~30 degrees from horizontal and generally parallel to foliation, gray. Marlborough Formation.
	25							Bottom of Boring 25 ft
	27.5							Truck-mounted drill rig. 4-inch casing to 19 ft. Safety-hammer with rope and cathead for SPT. Backfilled with drill cuttings.
	30							

BLOWS PER 6 IN.–140 LB. HAMMER FALLING 30 IN. TO DRIVE A 2.0 IN. OD SPLIT SPOON SAMPLER
PEN–PENETRATION LENGTH OF SAMPLER OR CORE BARREL
REC–RECOVERY LENGTH OF SAMPLE
RQD–LENGTH OF SOUND CORES > 4 IN./ LENGTH CORED, %
S–SPLIT SPOON SAMPLE
U–UNDISTURBED SAMPLES, UF–FIXED PISTON UO–OSTERBERG
▽ GROUNDWATER

NOTES:
1: Groundwater at 10 ft depth at start of day 2/15/07.

PROJECT 07999-0
DATE

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EXAMPLE SOIL DESCRIPTIONS

SANDY SILT (ML) ~60% slightly plastic fines, ~40% mostly fine sand, 1" thick layer of fine to medium sand with <20% fines, gray.

LEAN CLAY (CL) ~90% moderately plastic fines, ~10% fine sand, olive. Boston Blue Clay. Sv = 0.5, 0.5, 0.8 tsf, Qp = 1.0, 1.5, 1.6 tsf

Stratified CLAYEY SAND (SC) and WIDELY GRADED SAND (SW) SC layers 1 to 2 inches thick consist of fine sand with ~30% moderately plastic fines, gray. SW layers 1 to 4 inches thick consist of fine to coarse sand, ~10% gravel to 1/2 inch, <5% fines, brown. Hydraulic Fill.

EXAMPLE ROCK DESCRIPTIONS

(0-9"): GRANITE, hard, one piece, joint surface slightly weathered, pink.
(6-60"): PHYLLITE, joints ~ 45° generally parallel to foliation, 9" to 44" moderate to severe jointing and joint weathering. 44" to 60" single piece, green-gray.

ARGILLITE, medium hard, moderately weathered joints, gray. Cambridge Argillite.

GEOPROBE AND ROTOSONIC

When SPTs are not performed, note sample density (sands) or stiffness (clays) in description.

CRITERIA FOR DESCRIBING DILATANCY OF FINE-GRAINED SOILS

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing.
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing.

SPT: Standard Penetration Test

30-inch drop with 140-lb hammer
1 3/4 to 2 1/4 turns around cathead
2-inch O.D. split spoon sampler

ENV'L TERMINOLOGY FOR SOIL DESCRIPTIONS

- **Ash** - Typically silt-size to medium sand-size.
- Do not use the term "cinders." This is not a technical term. Instead, use "ash," "burnt wood," "burnt material," or a similar term.
- **Coal-like material** - If it looks like coal but you aren't sure.
- **Clinker** - Vitrified (glass-like) or heat-fused material. Often burned impurities in coal. Often looks like pumice, but heavier.
- **Slag** - Similar to clinker, but normally refers to residue from metal ore processing.

- **Sheen** - Iridescent petroleum-like sheen. Not to be used for a "bacterial sheen," which can be distinguished by its tendency to break up on the water surface at angles. Petroleum sheen will be continuous and will not break up.
- **Stained** - Use with a color ("brown-stained") to indicate that the soil is stained a color other than its natural (unimpacted) color.
- **Coated** - Soil grains are coated with NAPL (oil, tar, etc.). There is not enough NAPL to saturate the pore spaces. ("Split spoon sampler coated with brown oil." "Soil grains coated with gray substance with slight gasoline-like odor.")
- **Saturated** - The entire sample pore space is saturated with NAPL. If you use this term, be sure it is not water saturating the pore spaces. Depending on viscosity, the NAPL may drain from a soil sample. ("Sample saturated with green, sticky substance.")
- **Blebs** - Discrete sphericals of NAPL in a soil matrix that was not visibly coated or saturated. ("Occasional blebs of reddish-brown tar.")
- **Oil** - Exhibits a petroleum odor, different from MGP odors.
- **Tar** - Exhibits an MGP odor (e.g. naphthalene-like odor).

- **Odors** - Use terms such as "naphthalene-like odor" or "petroleum-like odor." Use modifiers (strong, moderate, slight) to indicate odor intensity.

STANDARD OPERATING PROCEDURE

SM-004 Test Pit Excavation

1. Objective

The test pit is used to characterize geologic strata, collect representative soil samples, and provide good visual access to subsurface structures that may be source areas.

2. Execution

- Complete utility markout procedures in accordance with PM-001.
- Have contractors steam clean equipment before beginning field activities.
- In certain locations, arrangements must be made to cut pavement.
- Excavate the designated area using a backhoe or excavator to required dimensions. Place excavated material that has suspected and/or visible contamination on a plastic liner away from the excavation.
- During excavation, monitor ambient air for Volatile Organic Compounds (VOCs) or other contaminants of concern. Record readings in field notebook (see SOP FD-001, *Field Notebook*).
- Describe sidewall strata, test pit dimensions, and soil classifications on test pit log (see SOP SM-003, *Soil Classification*). Record the presence and size of existing obstructions and any existing foundations. Take photographs of excavation sidewalls (SOP FD-004 *Photo Documentation*).
- Record technical information on test pit log form, not in a field book. Use the field book to record daily activities and test pit locations.
- Detect and describe boundary between fill and natural soil.
- Label sample bottles (see SOP SC-002, *Sample Handling*).
- If required in the work plan, collect soil samples from the test pit sidewalls and bottom at designated depths, at strata changes, or based upon field screening using equipment (backhoe bucket, stainless steel remote sampler, etc.) designated in the field plan. Do not enter a test pit unless side slopes satisfy Occupational Safety and Health Administration (OSHA) regulations and other health and safety concerns have been addressed.
- Transfer sample to the appropriate glassware with a decontaminated stainless steel trowel or spatula (see SOP QA-001, *Equipment Decontamination*).
- Store samples on ice in a cooler (see SOP SC-002, *Sample Handling* and SOP FD-003, *Chain of Custody*).

- Screen soil samples for VOCs or other contaminants of concern and record results in the field notebook.
- Measure dimensions of excavation and record in the field notebook.
- Sketch dimension and location of the test pit relative to a site reference point and record in the field notebook. Note the sample locations by number on a cross-section sketch and plan view sketch.
- Backfill excavation as soon as possible with material designated in field plan. Segregate contaminated soil as necessary (see SOP SC-003, *Investigation Derived Waste*). Replace soil in lifts as it was removed originally. Properly identify segregated material and secure as designated in the field plan.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- NEVER CLIMB INTO THE EXCAVATION TO COLLECT A SOIL SAMPLE unless the excavation is shored or the sidewalls are sloped in accordance with OSHA regulations and all proper personal protective safety precautions have been considered and implemented.
- Terminate excavation if the flow of ground water into the excavation adversely affects the stability of the excavation (i.e., slumping). Make sure to note in the field notebook the depth to ground water.
- Terminate excavation if drums, tanks, or other potential sources of contamination are observed. Record visible drum markings, labels, and any other pertinent information on the test pit log and in the field notebook. Photograph drums and materials.
- Do not leave an open excavation unattended without isolating it from passerby and vehicular traffic.

4. References

Earth Manual (1968), United States Department of the Interior, Bureau of Reclamation, United States Government Printing Office, Washington, D.C., pp. 134-139.

OSHA Standards for Excavations, Department of Labor, Federal Register, 29 CFR Part 1926, Aug. 9, 1994.

STANDARD OPERATING PROCEDURE

SM-005 Underground Storage Tank (UST) Removal and Closure Process

1. Objective

To provide a standardized approach for observing Underground Storage Tank (UST) removals that addresses the environmental issues associated with the removal. Consult local regulations and New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10, Technical Guidance for Site Investigation and Remediation dated May 3, 2010 to ensure proper closure procedures in addition to this standard operating procedure (SOP).

2. Execution

- Verify that all appropriate parties (contractors, National Grid, fire department, Town, County fire marshal and Health Department, NYSDEC Bulk Petroleum Storage Section [10 day notice], local entities, etc.) have been contacted and notified regarding the intended UST removal(s). Verify, with the contractor or National Grid that all necessary permits have been obtained by the appropriate parties prior to tank removal.
- Comply with Utility Markout SOPs PP-002 and PP-003.
- Prepare a site diagram/sketch detailing location of tank(s), structures, the location of any known fill and vent pipes, adjacent properties, buildings, utilities (where known), and any adjacent surface water(s). Record information in the field notebook (see SOP FD-001, *Field Notebook*).
- Observe/verify/confirm with the removal contractor that all liquids have been removed from the tank and associated piping. All exposed product lines should be drained, disconnected, and capped with sorbent padding to catch any leakage (recording contractors' activities).
- Observe/verify/confirm with contractor that the tank has been rendered free of explosive vapors.
- Request that any pavement or blacktop on top of the tank area is removed and segregated away from excavation and soil stockpile areas.
- As soil is removed from excavation, initiate soil screening and segregation procedures as directed by SOP SM-004, *Test Pit Excavation* and the site-specific Field Plan.
- If a spill is discovered, contact National Grid immediately prior to reporting the spill to the NYSDEC Spill Hotline (800-457-7362).
- Once the tank is exposed, observe the tank, piping, and other tank features for corrosion, holes, etc. Photograph tank, piping, and

excavation floor and sidewalls in accordance with SOP FD-004, *Photo Documentation*.

- After the tank and associated piping is removed or capped, continue field screening and soil excavation. The excavation floor and sidewalls should be examined for any physical evidence of soil or groundwater contamination and field screened (see SOP SC-004) with an appropriate and calibrated tool along transects spaced no more than 5 feet apart, so that sampling may be biased to the suspected location of greatest contamination.
- If there is no evidence of a discharge, confirmation soil samples for laboratory analysis should be collected (see SOP SM-001) immediately after tank removal, as follows:
    1) If there is no groundwater in the excavation, discrete center line soil samples from the bottom of the excavation are required as follows:
        a) At a frequency equal to the total length of the tank in feet divided by five (minimum of one sample).
        b) Samples are to be spaced equidistantly.
        c) The outermost samples obtained should be greater than 2.5 feet from each respective end of the tank.
        d) If the total length of a tank in feet is not evenly divisible by five, one additional sample should be obtained for any fraction remaining.
        e) A minimum of one groundwater sample(s) must be collected within 25 feet hydraulically down gradient from the tanks that are not co-located if the product stored is gasoline and groundwater is within 20 feet of the surface.
    2) If groundwater in the excavation and the contents of the UST have ever had a density less than or equal to water, soil samples should be collected as follows:
        a) One sample biased based upon field screening to the suspected location of greatest contamination should be collected near or above the water table from each excavation sidewall for every 30 linear feet of sidewall (minimum of one sample per sidewall).
        b) For heating oil tanks of 550 gallon capacity or less, one sample biased to the suspected location of greatest contamination may be collected from one excavation sidewall near or below the water table and one at the bottom of the excavation.
        c) Where seasonal fluctuations in the water table elevation can submerge and smear product over a range of several feet, additional samples should be considered in this smear zone.

d) A sample of the water in the excavation should also be collected.

3) If groundwater in the excavation and the contents of the UST had a density greater than water, soil samples should be collected as follows:
   a) Grab samples should be collected in the excavation at a depth from 0 to 2 feet beneath the tank in accordance with sampling scheme (1) above.
   b) These samples should be field screened.
   c) The four samples with the highest field screening results should be submitted for the appropriate laboratory analysis.
   d) A sample of water in the excavation should also be collected.

- If there is evidence of a discharge, excavation should continue, at National Grid and/or the Project Manager's direction, until all contaminated soil is removed or until further excavation is not feasible. Once excavation is complete and if no groundwater is encountered, confirmation soil sample should be collected to demonstrate that contamination has been removed, as follows:
  1) A minimum of five soil samples should be collected, consisting of four sidewall and one bottom sample for each 15 linear feet of trench.
  2) The samples should be biased based upon field screening toward the suspected location of greatest contamination.
  3) If there is evidence of further contamination but there is insufficient soil to conduct a soil remedial action or any portion of the tank is located within or immediately above the groundwater table, a groundwater sample should be collected.
- If there is any evidence of groundwater contamination, including without limitation a sheen or odor or if groundwater is within 20 feet of the surface, a groundwater sample should be collected and soil samples collected as follows:
  1) A minimum of five soil samples should be collected, consisting of four sidewall and one bottom sample for each 15 linear feet of trench.
  2) The samples should be biased based upon field screening toward the suspected location of greatest contamination.
  3) If there is evidence of further contamination but there is insufficient soil to conduct a soil remedial action or any portion of the tank is located within or immediately above the groundwater table, a groundwater sample should be collected.

- Backfill excavation according to the site-specific work plan guidelines and/or applicable state requirements (clean backfill, excavated materials).
- If contaminated soil is excavated, it should be stockpiled on and covered with polyethylene sheeting.
- All waste derived from the above activities should be properly disposed off-site consistent with regulatory requirements.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Ensure that the excavation does not undermine adjacent structures, footings, etc.
- Maintain all manifests.
- Trucks pumping flammable liquids should always be properly grounded to eliminate any spark hazard.
- At no time should any personnel enter the tank without implementation of a confined space safety plan.
- The site-specific plan should specify the responsibilities of GEI, National Grid, and the contractor.

4. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

GEI Technical Manual, dated July, 1987.

Removal and Disposal of Used Underground Storage Tanks, API.

Recommended Practice 1604 (1987), American Petroleum Institute, Washington, D.C.

Tanks and Containers (1989), Massachusetts Board of Fire Prevention, 527 CMR 9.00.

Management Procedures for Excavated Soils Contaminated With Virgin Petroleum Oils (1989), Massachusetts DEP BWSC, Policy #WSC-400-89.

Spill Technology and Remediation Series (STARS) Memo #1 (August 1992), NYSDEC.

Section 7

GROUNDWATER (GW)

STANDARD OPERATING PROCEDURE

GW-001 Water Level Measurement

1. Objective

The purpose of this Standard Operating Procedure (SOP) is to set guidelines for the determination of the depth to water in an open borehole, cased borehole, monitoring well, or piezometer.

2. Execution

- Prior to mobilizing onto a site, notification requirements must be followed.
- Prior to collecting water level measurements, all wells should be opened to the atmosphere and allowed to equilibrate prior to collecting groundwater elevation measurements.
- All groundwater level measurements need to be performed in the shortest possible timeframe (no more than four hours).
- Groundwater levels are measured using a decontaminated electronic groundwater level indicator, which has a cable divided into incremental measurements of 0.01 feet and two conductors forming a probe. When groundwater is encountered, the circuit is completed and a light, meter, or audible buzzer is activated. The depth to groundwater is then measured from this point to the reference mark on the inner casing of the monitor well.
- All groundwater-level measurements should be made from the same marked reference point at the top of the inner well casing. A licensed surveyor must mark the reference point.
- If no discernable survey mark is observed on the inner casing, the groundwater-level measurement should be read from the highest point of the inner casing.
- If no survey mark is observed on the inner casing, it should be noted with the ground water-level data and the highest point of the casing must be marked for future reference.
- Measurements should be made three to four times to confirm the measurement. Each time a measurement is made, it should be determined to the nearest one-hundredth of a foot (0.01).
- Certain situations may necessitate that all water level measurements at a given site should be collected within a shorter than 24-hour period. These situations may include:
    1. The magnitude of the observed changes between wells appears too large.
    2. Changes in atmospheric pressure.
    3. Aquifers which are tidally influenced.

4. Aquifers affected by river stage, impoundments, and/or unlined ditches.
5. Aquifers stressed by intermittent pumping of production wells.
6. Aquifers being actively recharged due to precipitation events.
7. Occurrence of pumping.

- All well measurements should be performed the same day, prior to the evacuation of any wells which may influence groundwater elevations in the area of the investigation.
- The following items should be recorded on field data sheets while collecting groundwater level measurements:
    1. Diameter of protective outer casing.
    2. Security and integrity of the well.
    3. The number of the well.
    4. Inner diameter and construction material of the inner well casing.
    5. Total depth of the well from the top of the inner casing or surveyor's mark, if present (measured to 0.01 foot).
    6. Depth from the top of the inner casing to ground water (recorded to 0.01 foot accuracy).
    7. Thickness of non-aqueous phase liquids (NAPL) product, if any. (See SOP GW-002, *NAPL Measurement*.)
    8. Calculation of the linear feet of water in the well by subtracting the depth to ground water from the total depth of the well.
    9. Calculation of the water table elevation in the well by subtracting the depth to ground water from the top-of-casing elevation.

3. Notes

- Do not measure the total-well-depth with an electronic groundwater level indicator.
- Groundwater levels should be obtained from all wells in a network prior to sampling the first well.
- All wells should be measured.
- Local water body elevations may need to be measured. Check site-specific work plan for this requirement.
- Weak batteries in electronic groundwater-level indicators frequently produce weak or gradual auditory and/or visual responses, making it difficult to accurately determine when the probe of the unit has come in contact with ground water. As such, it is recommended that electronic groundwater-level indicators be tested before they are brought out into the field.

- Note that electronic groundwater-level indicators will not respond to distilled water, so distilled water should not be used to test these units.
- Wells that are not plumb may result in probe contact with the side of the well casing providing a false measurement. Once the probe has come in contact with groundwater in the well, water may be trapped by capillary action between the probe and the well casing. If this happens, the unit may continue to signal even after the probe has been raised above the ground water surface. The deeper the well, the more likely this problem may occur. To correct this, the cable should be raised several feet above the water and shaken to remove water from the probe. A new groundwater-level measurement should then be collected. If the signals from the unit are not abrupt or reproducible, the probe may need to be reeled up to the surface and dried off before re-attempting another measurement.
- Accumulation of sediment, organic material, or floating debris on the probe may also result in gradual or non-reproducible readings. Wells that are constructed with metal inner casings may lead to difficulties in collecting reproducible groundwater-level measurements because the inner sides of the well casing are conductive.
- In some cases, a rubber grommet or metal centralizer may need to be placed on the probe so that the probe is not allowed to come in contact with the inner casing. Groundwater-level-measuring equipment should be properly decontaminated between wells and piezometers to avoid cross contamination.
- Once a well has been located and properly identified, the field measurements listed below should be noted in a field logbook. Be certain that the proper well is being measured. The misidentification of a sampling point in the field will result in erroneous data that may result in incorrectly constructed contour maps.

4. References

U. S. EPA Environmental Response Team Standard Operating Procedures SOP: 2043,"Water Level Measurement" REV: 0.0, 10/03/94.

U. S. EPA Environmental Response Team Standard Operating Procedures SOP: 2044," Monitor Well Development" REV: 0.1, 10/23/01.

5. Attachments

Attachment A – Monitoring Well Sampling Record

Attachment A

Monitoring Well Sample Data Form

Project: National Grid - **Well ID:** _____ **Date:** _____

Total Well Depth (from top of casing): _____

Depth to Water (from top of casing): _____

Well Diameter: _____

Pump Intake Depth: _____

Sampling Crew: _____

Purge Time: *Start:* _____ *Finish:* _____

Purging Method: _____

Sampling Method: Low Flow

Sample Time: *Start:* _____ *Finish:* _____

Sample Analysis: _____

Purge Data										
Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**
										Well Headspace PID =

Final Stabilization Data										
Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**

GEI Consultants

STANDARD OPERATING PROCEDURE

GW-002 Non-Aqueous Phase Liquid (NAPL) Measurement

1. Objective

To obtain accurate and repeatable measurement of the thickness of Non-Aqueous Phase Liquids (NAPL) contained in monitoring wells. This method can be applied to light non-aqueous phase liquids (LNAPL) and dense non-aqueous phase liquids (DNAPL).

2. Execution

Two procedures for measuring NAPL are provided below using a clear bailer and Interface Probe. Neither method is ideal, however, due to difficulties associated with the Interface Probe, use of the clear bailer is the preferred method to identify and estimate thickness of floating product in monitor wells.

2.1. Clear Bailer (LNAPL Measurement)

- Determine depth to the surface level of the LNAPL layer utilizing an interface probe.
- Record depth.
- Lower a clear bailer into the well and slowly into the product, being careful not to submerge the bailer.
- Raise the bailer and measure product thickness.
- Once the product thickness is known, the depth to ground water may be determined (see calculation below).
- This method has inaccuracies because successful use of the bailer is dependent upon the expertise of the operator and assumes the check valve does not leak upon retrieval.

2.2. Interface Probes (LNAPL Measurement)

- Decontaminate Interface Probe prior to use.
- Check battery and replace if necessary.
- Check the unit is functioning correctly. Note: De-ionized water will not provide a correct reading.
- Measure the hydrocarbon/air interface first by going from air to the LNAPL surface to prevent dripping hydrocarbons from enhancing the thickness reading.
- Record the reading.
- Measure the hydrocarbon/water reading by lowering the Interface Probe past the LNAPL layer quickly minimizing the contact time of the probe within the hydrocarbon phase.

- DNAPL can also be measured by quickly lowering the Interface Probe past the LNAPL layer and to the bottom of the well noting any audio or visual indications of DNAPL.
- The optical sensor on interface probes may become damaged if solvents are used to clean product from the probes.
- The optical sensor may become smeared when used to measure product, rendering pinpoint accuracy to an estimate at best.
- Close attention to decontamination procedures will improve accuracy, operational life, and reduce the risk of cross contamination with other wells.

2.3. Graduated Tape (DNAPL Measurement)

- Outfit a measuring tape with a narrow cylindrical weight that is heavy enough to sink through a viscous DNAPL.
- Open the well box or unlock the protective casing
- Lower the tape slowly through the water column in the well. When the tape reaches the bottom, stop releasing tape and measure the total well depth. Any extra tape released after the bottom of well was encountered will give a false reading of the DNAPL thickness. Repeat this procedure, if necessary.
- While extracting the tape, use absorbent rags and/ or GOJO Wipes to clean the tape. When the DNAPL line of demarcation is encountered on the measuring tape, record the thickness of DNAPL in the well.
- Clean the DNAPL from the tape over the well so excess DNAPL flows back into the well. This can lessen or eliminate the need to clean DNAPL from in or around the well box.
- Clean up any DNAPL in or around the well box.
- Repeat these steps as necessary to clean the tape and clean up the area around the well box.
- Decontaminate tape in accordance with SOP QA-001.
- Dispose of waste in accordance with SOP SC-003.
- Secure the well box or close and lock the protective casing.

3. Notes

- When measuring DNAPL, care must be taken when encountering the well bottom so a false measurement is not recorded.
- When a LNAPL thickness is measured in a monitoring well, it will usually exhibit an apparent thickness rather than an actual thickness. This apparent thickness is caused when LNAPL from within and above the capillary fringe migrates into the monitoring well causing the ground water-level to become depressed below

the surrounding capillary fringe area. As a result, LNAPL will continue to flow into the well until equilibrium is reached causing an apparent LNAPL thickness, which is greater than the actual thickness**.**

- LNAPL thickness can be affected by fluctuations in the water table. In some cases, an LNAPL's thickness may decrease when the water table rises, while its thickness increases as the water table drops. In other cases, fluctuating water tables may cause sudden appearances and disappearances of LNAPL layers.
- Monitoring points with LNAPLs can pose a problem when measuring the level of ground water. Floating LNAPLs can depress the ground water-level in a monitoring well or piezometer and distort the measurement. Therefore, the Corrected Depth (CD) formula shown below should be applied to ground water-level measurements in monitoring points where LNAPLs are present:

CDTW = Static DTW – (PT x G)

CDTW = Corrected Depth to Ground water
DTW = Depth to Ground Water (Static)
PT = Measured Product Thickness
G = Specific Gravity (density of free product / density of water)

4. References

U. S. EPA Environmental Response Team Standard Operating Procedures SOP: 2043,"Water Level Measurement" REV: 0.0, 10/03/94.

STANDARD OPERATING PROCEDURE

GW-003 Low Flow (Low Stress) Groundwater Sampling

1. Objective

Provide a method to collect groundwater samples that accurately and precisely represent the aquifer conditions. Low-flow purging is limited to wells that, with sustained pumping, exhibit no continuous drawdown.

2. Background for Implementation

- Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 nephelometric turbity units (NTUs), and stable drawdowns of less than 0.3 feet are recommended.
- It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions (e.g., insulation) will need to be taken to prevent the groundwater from freezing in the equipment.
- Direct sunlight and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, pipe insulation, etc.).
- The tubing exiting the monitoring well should be kept as short as possible to avoid sunlight or ambient air from heating up the groundwater. Tubing lengths greater than 6 feet should be fitted with 0.5-inch diameter pipe insulation.

3. Execution

- Complete site-access notification requirements prior to mobilization.
- Wait at least one week following well development before sampling.
- Record all activities in the field notebook (see SOP FD-001, *Field Notebook*) and on Attachment A – Monitoring Well Sample Data Form. Use a separate form for each sampling location and event.
- Calibrate the photoionization detector (PID), pH, temperature, specific conductance (SC), turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP) meters and record data on Attachment B – Portable Equipment Calibration Log.
- Check the well, the lock, and the locking cap for damage or evidence of tampering.
- Record observations.

- Remove well cap and, if appropriate, measure VOCs at the rim of the well with a PID or flame ionization detector (FID) instrument and record the reading in field notebook or well logs.
- Being careful to not disturb the water column, slowly and gently measure the depth to water with a water level probe and/or oil water interface probe. Do not measure depth to well bottom at this time (wait until sampling has been completed). Measure water level to the nearest 0.01 foot from the top of casing or the highest point (or "V" notch) on the polyvinyl chloride (PVC). If the top of casing cannot be used, note the reference location. Mark the datum point with an indelible marker and note reference location in field book.
- Check newly constructed wells for the presence of light non-aqueous phase liquid (LNAPL) or dense non-aqueous phase liquid (DNAPL) before the initial sampling event.
- If LNAPL is present, the tubing intake should be at the mid-point of the well screen. Initial purge water should not be sent through the field parameter meter flow cell but sent directly to the purge water container. After the initial column of purge water is poured, the field parameter meters may be placed inline and the collection of data may be started.
- If DNAPL is present, the tubing intake should be placed approximately 1 foot below the water table or to the approximate depth below the known drawdown depth (refer to previous sample logs).
- Calculate the well volume (V_w [gallons]) using the measured depth to water ($Depth_{water}$ [feet]), total well depth ($Depth_{total}$ [feet]), and well diameter:

  $$V_w = n \times (Depth_{total} - Depth_{water})$$

  1-inch well: n = 0.04
  2-inch well: n = 0.16
  4-inch well: n = 0.65
  6-inch well: n = 1.47

- Slowly and gently insert the pump intake tubing to the middle of the saturated screened interval, open borehole, or to the pre-determined sampling depth. The pump intake must be kept at least 2 feet above the bottom of the well to prevent disturbance or suspension of any sediment or DNAPL present in the bottom of the well. Record the depth of the pump intake.
- Start the pump on the lowest setting and increase slowly until flow begins. Adjust the pumping rate so that drawdown in the well is minimal (0.3 feet or less, if achievable). Use a pumping rate between

100 to 1,000 milliliters per minute (mL/min). Measure rates with a graduated container.

- Purge 1.5 well volumes at low flow rates checking for DNAPL migration. If no DNAPL migration is observed during the last 15 minutes of purging, begin collecting field data. If DNAPL migration occurs during the last 15 minutes of purging, abort sampling and document on sample log.
- Place decontaminated flow-cell inline with tubing and connect calibrated Horiba U-22 Multiparameter Water Quality Meter, or equivalent. Place flow-cell in shade or insulate.
- While purging, record water levels every five minutes, or as appropriate. A steady state flow rate will be maintained that results in a stabilized water level with a drawdown of 0.3 feet or less, if achievable.
- During purging, monitor and record, every five minutes, the water quality indicator parameters that include: pH, temperature, SC, turbidity, DO, and ORP.
- Purging is complete when, after three consecutive measurements, the water quality parameters have stabilized as follows:
    1. pH (+/- 0.1 standard units)
    2. temperature (3%)
    3. SC (3%)
    4. turbidity (10% for values greater than 5 NTU; if three turbidity values are less than 5 NTU, consider the values as stabilized)
    5. DO (10% for greater than 0.5 milligram per liter [mg/L] or 3 consecutive values less than 0.5 mg/L)
    6. ORP (+/- 20 millivolt [mV] or 10%, whichever is greater)
- Containerize purge water in tanks or 55 gallon steel drums.
- Collect the samples.
- Following purge, disconnect the flow-through cell and fill all containers from the discharge end of the tubing. Collect samples at a flow rate equal to the steady state purge rate.
- Fill sample containers directly from the sampling device in order of decreasing volatility (i.e., Volatile Organic Compounds [VOC] samples will be collected first; see SOP SC-002, *Sampling Handling*).
- Label each sample collected and store samples in a cooler (SC-002, *Sampling Handling*).
- Secure the well cap and manhole cover and restore well area to pre-sampling conditions.

4. Notes

- Prior to the field activities, obtain available information on well construction for use in field investigation (i.e., screen and riser

material, well diameter and depth, screened interval, optimum sampling depth, etc.).

- If using dedicated equipment, to the extent achievable install equipment into well at least 24 hours before sample collection to minimize disturbance of the water column and/or suspension of sediments or NAPL on bottom.
- To minimize the potential of cross-contamination between wells, dedicated, in-place pumps (and tubing) can be used.
- If the water quality indicator parameters do not stabilize after 2 hours, then either continue purging or, contact the Project Manager.
- All sample containers are to be filled with minimal turbulence by allowing the groundwater to flow from the tubing gently down the inside of the container.
- Be aware of any preservatives in the sample bottles and handle with care, in accordance with the Health and Safety Plan.

5. References

Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samles From Monitoring Wells (January 19, 2010), USEPA Region-1, EQASOP-GW 001.

Standard Reference for Monitoring Wells (April 19, 1991), Massachusetts DEP, DEP Publication No. WSC-310-91.

Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures (1996), R.W. Puls and M.J. Barcelona, U.S. Environmental Protection Agency, EPA/540/S-95/504.

Reproducible Well-Purging Procedures and VOC Stabilization Criteria for Ground Water Sampling (1994), M.J. Barcelona, H. A. Wehram, and M.D. Varljen, Ground Water, Vol. 32, No. 1, 12-22.

Low-Flow Purging and Sampling of Ground Water Monitoring Wells with Dedicated Systems (1995), R.W. Puls, and C.J. Paul, Groundwater Monitoring and Review, Summer 1995 116-123.

Ground Water Sampling Procedure Low Stress (Low Flow) Purging and Sampling, (1998), Ground-Water Sampling SOP, Final, U.S. Environmental Protection Agency, Region II, March 16, 1998.

RCRA Ground-Water Monitoring: Draft Technical Guidance, (1993), U.S. Environmental Protection Agency, EPA/530-R-93-001.

To Filter, or Not to Filter, That is the Question, (1997), Special Topics Subcommittee Letter Report EPA-SAF-EEC-LTR-97-011, April 29, 1997,

Meeting, U.S. Environmental Protection Agency, Science Advisory Board Environmental Engineering Committee, September 5, 1997.

Should Filtered or Unfiltered Groundwater and Surface Water Samples be Collected for the Risk Assessment?, (1995), MCP Q&A: Subparts I and J, Special #4, Bureau of Waste Site Cleanup, Massachusetts Department of Environmental Protection (DEP), February, 1995.

6. Attachments

Attachment A – Monitoring Well Sample Data Form
Attachment B – Portable Equipment Calibration Log

Attachment A

Monitoring Well Sample Data Form

Project: National Grid - Rockaway Park MGP Site **Well ID:** _____ **Date:** _____

Total Well Depth (from top of casing): _____

Depth to Water (from top of casing): _____

Well Diameter: _____

Pump Intake Depth: _____

Sampling Crew: _____

Purge Time: *Start:* _____ *Finish:* _____

Purging Method: _____

Sampling Method: Low Flow

Sample Time: *Start:* _____ *Finish:* _____

Sample Analysis: _____

Purge Data										
Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**
										Well Headspace PID =

Final Stabilization Data										
Sample Time	**Flow Rate** *(lpm/gpm)*	**Volume Purged** *(liters/gals.)*	**pH** *(std. Units)*	**Conductivity** *(mS/cm)*	**Turbidity** *(NTU)*	**Dissolved Oxygen** *(mg/l)*	**Temperature** *(Cel.)*	**Salinity** *(%)*	**ORP** *(mV)*	**Comments/Observations**

Attachment B

Portable Equipment Calibration Log

Date: _____

Equipment Information

Equipment Type: _____

Manufacturer and Model: _____

Identification Number: _____

Calibration Information

Time	Parameter	Initial Reading	Calibration Value	Lot No.	Expiration	Final Reading

Notes:

Record information for all calibrated parameters.

If performing zero and span calibration, use a separate line for each.

Comments/Observations

STANDARD OPERATING PROCEDURE

GW-004 pH and Temperature Measurement

1. Objective

The objective of this Standard Operating Procedure (SOP) is to provide standard methods for determining the pH and temperature of liquids using a combination pH/temperature meter.

2. Execution

- Calibrate the meter according to the equipment manufacturer's instructions at the beginning of each day of use. Calibration for pH shall be performed using at least two buffer solutions from various ranges. Solutions chosen should be similar in pH to the expected level of the samples or liquids tested (pH 7 and four buffer solutions are preferred in most cases for ground or surface water measurements). Record data on Attachment A – Portable Equipment Calibration Log.
- Calibration is checked every two hours or every five monitoring locations, whichever occurs first, and at the end of the day by measuring the two calibration solutions used. The reading and times are recorded. If the readings are outside +/– 0.2 pH units, the meter must be recalibrated.
- Immediately prior to testing a sample, decontaminate testing beaker or container and probe assembly with one rinse of sample solution. Do not use methanol to rinse the probe. Methanol rinses could damage the probe.
- Gently shake the probe and beaker to remove excess solution. Visually inspect the bottom of the probe to ensure that liquid or sediment is not trapped between outer casing and probe.
- Pour the sample into the testing container and insert both temperature and pH probe. Stir sample for 30 seconds using both probes. Let the probes equilibrate in the sample solution for another 30 seconds. Measure and record the temperature. A reading has stabilized if pH units have not changed +/– 0.1 pH units during a five second period.
- Record pH to the nearest 0.1 unit and temperature to the nearest whole number.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.

- Coatings and particulates may affect the response of the probe; more thorough cleaning with distilled water and gently wiping the probe surface may be required to clean the surface of the probe.
- Temperature affects both the response of the instrument to pH and the actual pH of the sample. The Automatic Temperature Compensation (ATC) function compensates for the variation in the response of the meter only. Therefore, the pH must always be reported with temperature.
- The probe is a fragile thin glass bulb surrounded on three sides by a plastic casing. Care must be taken in handling the probe to avoid breakage.
- Buffer solutions should not be used past their expiration date.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Attachment

Attachment A – Portable Equipment Calibration Log

Attachment A

Portable Equipment Calibration Log

Date: _____

Equipment Information

Equipment Type: _____

Manufacturer and Model: _____

Identification Number: _____

Calibration Information

Time	Parameter	Initial Reading	Calibration Value	Lot No.	Expiration	Final Reading

Notes:

Record information for all calibrated parameters.

If performing zero and span calibration, use a separate line for each.

Comments/Observations

STANDARD OPERATING PROCEDURE

GW-005 Turbidity Measurement

1. Description

A nephelometer/turbidimeter is used in comparing the turbidity of liquids by viewing light through them and determining how much light is eliminated. Turbidity readings are required to be read using a portable (e.g. Horiba or Hach) instrument outside the flow-through cell.

2. Execution

- Turn the meter "ON".
- Calibrate the meter according the manufacture's specifications and record data on Attachment A – Portable Equipment Calibration Log.
- Rinse the sample cell three times with organic free or de-ionized water.
- Fill the cell to the fill line with organic free or de-ionized water and then cap the cell.
- Use a non-abrasive lint-free paper or cloth (preferably lens paper) to wipe off excess water and streaks.
- Open the cover and insert the cell (arrow to the front) into the unit and close the cover.
- Press "READ" and wait for the 'light bulb' icon to go off. Record the reading.
- Using the Gelex standards, repeat steps above. Record all measurements (note anomalies).
- Collect a representative sample or use a portion of the sample that is collected for pH, temperature, or conductivity analysis, and pour off enough to fill the cell to the fill line (about 15 milliliters [ml]) and replace the cap on the cell.
- Wipe off excess water and any streaks with a soft, lint-free cloth (lens paper).
- Press "I/O" and the instrument will turn on. Place the meter on a flat, sturdy surface. Do not hold the instrument while making measurements.
- Insert the sample cell in the instrument so the diamond or orientation mark aligns with the raised orientation mark in the front of the cell compartment. Close the lid.
- Select manual or automatic range selection by pressing the range key.

- Select signal averaging mode by pressing the “Signal Average” key. Use signal average mode if the sample causes a noisy signal (display changes constantly).
- Press Read. The display will show “---- NTU” and then the turbidity in nephelometric turbidity units (NTUs). Record the result after the lamp symbol turns off.
- Rinse the cell with de-ionized water.
- Perform an operational check.
- Periodically check the turbidity meter during the day by using the Gelex secondary standards provided.
- Perform a post calibration at the end of the day and record all measurements.

3. Notes

- Turbidity measurements are reported in NTUs. It is important to note that if the turbidity measurements are for National Pollutant Discharge Elimination System (NPDES) reporting purposes, all values above 40 NTU must be diluted with turbidity free water and calculated by multiplying by a dilution factor.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

STANDARD OPERATING PROCEDURE

GW-006 Specific Conductance Measurement

1. Objective

The objective of this Standard Operating Procedure (SOP) is to provide standard methods for determining the conductivity of waters using a field conductivity meter.

2. Execution

- Calibrate the meter according to equipment manufacturer's instructions at the beginning of each day of use and record data on Attachment A – Portable Equipment Calibration Log. Calibration shall be performed using a standard KCl solution of 0.20 mS/cm (200 uS/cm, S=mho).
- Calibration is checked at the beginning of the day immediately prior to sampling, after five sampling locations or two hours (whichever occurs first), and at the end of the day. If the readings are outside +/- 0.02 mS/cm, the meter must be recalibrated. Initial calibration should be conducted under the same conditions (i.e., temperature, and location) of field testing.
- Immediately prior to testing a sample, decontaminate testing beaker or container and probe assembly with one distilled water rinse, and one sample solution rinse.
- Gently shake the probe and beaker to remove excess solution.
- Pour sample into the testing container and insert probe. Stir sample with the probe for approximately 10 seconds. Let the probe equilibrate in the sample solution for another five seconds. Measure conductivity and record in the field notebook.
- Record conductivity to the nearest whole number.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Coatings and particulates may affect the probe's response; more thorough cleaning using a weak alconox solution and double distilled water rinse and gently wiping the probe surface may be required to clean the surface of the probe.
- If contaminated, (e.g., stained, conductance >750 mhos/cm), rinse probe with clean water immediately after measuring sample to minimize fouling of probe.
- Calibration solutions should not be used past their expiration date and must be discarded after three months of use.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Attachment

Attachment A – Portable Equipment Calibration Log

STANDARD OPERATING PROCEDURE

GW-007 Dissolved Oxygen Measurement

1. Objective

To accurately quantify dissolved oxygen (DO) in water.

2. Execution

Typically, the Horiba U-22 Multiparameter Water Quality Meter is used to measure groundwater DO during low-flow purging activities. However, a Hach DO test kit may be utilized, as necessary.

Horiba U-22 Multiparameter Water Quality Meter

1) Calibrate meter in accordance with manufactures specifications.
2) Calibrate the meter according to equipment manufacturer's instructions at the beginning of each day of use and record data on Attachment A – Portable Equipment Calibration Log.
3) In accordance with SOP GW-003, connect decontaminated meter inline with purge/sample tubing utilizing decontaminated flow-cell.
4) Record DO readings during monitoring well purging in accordance with SOP GW-003

Hach DO Test Kit

High Range Test (1 to 20 milligrams per liter [mg/L])

1) Fill the DO bottle (round bottle with glass stopper) with sampling water by allowing the sample water to overflow the bottle for 2 to 3 minutes. Avoid turbulence and bubbles in the sample while filling.
2) Incline the bottle slightly and insert the stopper with a quick thrust to avoid trapping air bubbles. If bubbles become trapped, discard the sample and repeat the test.
3) Remove the stopper and add the contents of one DO 1 Reagent Power Pillow and one DO 2 Reagent Powder Pillow. Stopper the bottle carefully to avoid trapping air bubbles. If bubbles become trapped, discard the sample and repeat the test.
4) Shake the bottle vigorously to mix. Flocculant (floc) precipitate will form. Brownish-orange precipitate indicates oxygen is present.
5) Wait for floc to settle to approximately half the bottle volume. Floc will not settle if high concentrations of chloride are present. In this case, wait 4 to 5 minutes before proceeding.
6) Shake the bottle vigorously again.
7) Wait for the floc to settle halfway. Floc will not settle if high concentrations of chloride are present. In this case, wait 4 to 5 minutes before proceeding.

8) Remove the stopper and add the contents of one DO 3 Reagent Powder Pillow. Stopper the bottle carefully to avoid trapping air bubbles. If bubbles become trapped, discard the sample and repeat the test.
9) Shake the bottle vigorously to mix. Floc will dissolve and the sample will turn yellow if oxygen is present.
10) Fill plastic tube full (to the top) with prepared sample.
11) Save the rest of the prepared sample for the Low Range Test, if necessary.
12) Pour the contents of the tube into a square mixing bottle.
13) Add Sodium Thiosulfate Standard Solution one drop at a time to the mixing bottle. Count each drop. Swirl to mix after each drop. Add drops until the sample becomes colorless.

Low Range Test (0.2 to 4 milligrams per liter [mg/L])

1) Use the prepared sample left from Step 11 of the High Range Test. Pour off the contents of the DO bottle until the level reaches the 30 ml mark on the bottle.
2) Add Sodium Thiosulfate Standard Solution one drop at a time to the DO bottle. Count each drop. Swirl the bottle after each drop is added. Add drops until the sample becomes colorless.
3) Multiply by 0.2 the number of drops of titrant used. This is the total mg/L.

3. Notes

- Collecting measurements from samples in containers will alter the gaseous content of the sample.
- Freshwater can hold more oxygen than saltwater. The dissolved salt forces dissolved gas out of water thereby lowering the solubility of water. A known relationship between salinity and dissolved oxygen concentration allows for a correction for salinity.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

5. Attachment

Attachment A – Portable Equipment Calibration Log

STANDARD OPERATING PROCEDURE

GW-008 Temporary Groundwater Sampling Points

1. Description

A well point is a small diameter (1-2 inch) probe constructed of continuously wrapped stainless steel or wrapped stainless steel gauze screen over perforated carbon steel pipe. They may be used as a screening tool to collect ground water samples and piezometric data to aid in the optimal placement of monitor wells. No filter or gravel pack is used in the installation.

2. Execution

2.1. Installation

- The well point can be placed with the use of a conventional hollow-stem auger rig, slide hammer, jack hammer, rotary hammer, or by hand.
- The well point may be driven through the unsaturated zone only in known "clean" soils. Driving the well point through contaminated soil may carry some contamination with the point resulting in analytical sample results which are biased high. In contaminated unsaturated zones, the well points must be placed with the aid of a hollow-stem auger.
- If the well point is to be installed in an oversized (20% larger than the well point) pre-drilled hole, the hollow-stem augers or bull drive point must be advanced to a point which is just above the targeted sample zone. The well point is then placed in the hole and advanced beyond the bottom of the hole by hammering or pushing into place. The use of pre-drilled holes will reduce clogging of well point screens when driving.
- After sample collection, the well point is removed by back hammering or pulling the tool out with the rig hydraulics.
- If the well point is to be left as a permanent installation, it must be constructed and permitted as per local regulatory monitor well requirements.
- If the well point is used for piezometeric data, a survey mark must be made on top of the casing as a reference point for water level measurements.

2.2. Sampling Procedures

2.2.1. Development

Development of a well point is not required except when performing vertical profile sampling. The well point must be developed by one of the standard methods used for well development prior to sampling. If an air lift

development technique is used, the air outlet must be at a minimum of two feet above the screen. Operations must be continuous and not pulsed. The air lift pipe shall not be placed within the screen and only the double pipe method shall be used.

2.2.2. Purging

Purging of the well point is required.

2.2.3. Sampling

The acquisition of ground water samples and piezometric data must be performed by one of several recommended methods described in the associated SOP.

3. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

Ground Water and Wells. Johnson Division, UOP Inc.; St. Paul, Minn. 1982. p277-294.

Ground Water Manual - A Water Resources Technical Publication; U.S. Dept. of Interior, Bureau of Reclamation. Government Printing Office,Washington DC 1977.

STANDARD OPERATING PROCEDURE

GW-009 Potable Well Sampling

1. Objective

To collect a sample representative of a drinking water supply and to reduce the bias of system related variables (pumps, piping, holding tanks, etc.).

2. Execution

- When sampling potable water supplies, conduct an initial survey to get a general overview of the water system and its operation.
- Note how the configuration of the system relates to the type of sample that you want to collect (raw water, finished/treated water, or an intermediate sampling point).
- Inquire as to whether any treatment units are installed on the system. Softening (pH adjustment), iron removal, turbidity removal, and chlorination, are often used; these may give misleading analyses depending upon the parameters of interest.
- Home carbon filters used for the removal of organics have become increasingly popular. Basement and outside faucets may by-pass such treatment systems.
- Important considerations to record are:
    1. Well driller and date drilled.
    2. Construction of well and casing depth.
    3. Well and pump location.
    4. Well depth and pump capacity (if available).
    5. Storage tank capacity.
    6. Treatment or conditioning unit (if any).
    7. Plumbing arrangement.
    8. Possible sample collection points.
    9. Distance of well to any septic systems or underground storage tanks.
    10. Aesthetic information (color, odor, observed suspended material).
- Obtain the name(s) of the resident or water supply owner/operator, the resident's exact mailing address, and the resident's home and work telephone numbers. The information is required so that the residents or water supply owner/operators can be informed of the results of the sampling program.
- For long term monitoring projects which include sample collection from domestic wells, a specific tap or faucet should be designated as the target sample access point for consistency and data comparability of future samples.

- The sample should be collected from a tap or spigot located at or near the well head or pump house and before the water supply is introduced into any storage tanks or treatment units.
- If the sample must be collected at a point in the water line beyond a pressurization or holding tank, a sufficient volume of water should be purged to provide a complete exchange of fresh water into the tank and at the location where the sample is collected.
- Home faucets, particularly kitchen faucets, usually have a screen (aerator) installed on the discharge. The screen must be removed prior to sampling for bacteria, or for volatile organics, since the screen tends to aerate the water and some organics may be lost. Also, when sampling for bacteria, do not take a sample from a swivel faucet since the joint may harbor a significant bacterial population.
- If the sample is collected from a tap or spigot located just before a storage tank, spigots located inside the building or structure should be turned on to prevent any backflow from the storage tank to the sample tap or spigot. It is generally advisable to open several taps during the purge to ensure a rapid and complete exchange of water in the tanks.
- Purge the system for at least 15 minutes when possible. After purging for several minutes, measure the turbidity, pH, specific conductivity, and temperature of the water. Continue to monitor these parameters until three consistent readings are obtained. If possible, obtain three consistent readings after the 15 minute purge.
- After three consistent readings have been obtained, samples may be collected.
- When sampling for bacterial content, the sample container should not be rinsed before use due to possible contamination of the sample container or removal of the thiosulfate dechlorinating agent (if used).
- When filling any sample container, care should be taken that no splashing drops of water from the ground or sink do not enter into either the bottle or cap.
- When sampling at a water treatment plant, samples are often collected from the raw water supply and the treated water after chlorination.

3. Notes

- Homeowners' plumbing systems should not be altered, except for removal of the faucet screen (aerator) with permission of the homeowner.
- Under no circumstance shall a pump be pulled from a homeowner's well unless the removal is authorized by the homeowner and is carried out by a licensed pump installer. Pump installers are trained professionals with experience in the electrical and plumbing aspects

of well pumps. In addition pump installers are trained in the proper chlorination of wells after work is completed and will advise homeowners of any precautions to take to avoid excess rust from entering their system.

- When sampling industrial wells, it is desirable to sample as close to the well source as possible. Samples should be taken directly from the well head whenever possible. This will eliminate treatment interference, possible changes in quality within the lines, and mixing of water from other wells, etc. Large capacity wells, which are *on-line* during the visit, can be sampled immediately. Wells, which are *off-line*, must be pumped to waste prior to sampling. Pumping fifteen minutes or more is suggested.

4. References

Standard Methods for the Examination of Water and Wastewater, 18th Edition, Method 4500-H. American Public Health Association (1992).

Ground Water and Wells. Johnson Division, UOP Inc.; St. Paul, Minn. 1982. p277-294.

Ground Water Manual - A Water Resources Technical Publication; U.S. Dept. of Interior, Bureau of Reclamation. Government Printing Office,Washington DC 1977.

STANDARD OPERATING PROCEDURE

GW-010 Slug Tests

1. Objective

To determine the horizontal hydraulic conductivity of distinct geologic horizons using wells or piezometers.

Slug tests can be performed on single monitoring wells to estimate the hydraulic conductivity of the aquifer. The approximate horizontal hydraulic conductivity of a given aquifer zone may be determined by first adding or removing a known volume (slug) to or from the well, then observing and recording the subsequent rate of water level fall or rise within the well. The resulting data will be used to determine the hydraulic conductivity of the aquifer test zone using an appropriate analytical solution method. A slug bar or bailer of known volume will be used to alter the water levels in the wells.

Falling head tests are to only be performed in fully-penetrating wells (well screened completely below the water table). Rising head tests can be performed in both fully- and partial-penetrating wells.

2. Execution

2.1 Setup

- Determine the way that water levels will be recorded. If the geologic materials in the test zone are expected to be only slightly permeable (e.g., a glacial till or clay), then accurate measurements may be recorded manually with an electronic water level indicator. If the geologic materials in the test zone are expected to be moderately- or highly-permeable (e.g., outwash sands), then use a pressure transducer attached to an automatic data logger. The remainder of this Standard Operating Procedure (SOP) assumes that an automatic data logging system is being used to perform the test.
- Check to see if test equipment functions prior to leaving for the site.
- Decontaminate the transducer and cable. Do not use a transducer in wells containing non-aqueous-phase liquid (NAPL).
- Make initial water level measurements and test wells from the least contaminated to the most contaminated, and from low to high expected permeability, where possible.
- The static water level (i.e., depth to water) in the well to be tested will be manually measured and recorded using an electronic water level indicator. All measurements taken during the test will be recorded in the field log book.

- The pressure transducer should be installed as far below the deepest point of insertion of the slug bar or bailer as possible. The transducer should be allowed to thermally equilibrate for 15 to 30 minutes (to allow instrumentation wiring to expand/contract) before measurements are taken.
- Secure the transducer cable at ground surface with tape or weight to keep the transducer at a constant depth.
- Cover sharp edges of the well casing with duct tape to protect the transducer cables.
- Transducer measurement setup: For wells screened in sand and silty sand, a linear setting of one reading per second is generally used. In coarser soil where full recovery may occur over a few seconds, a linear setting for more frequent readings will be necessary. If a transducer is used for silt and clay, a linear setting of one reading per minute, or a logarithmic setting, should be used to avoid risk of exceeding the memory capacity of the transducer.

2.2 Field Procedure – Rising Head Test

- Log the initial water level on the attached form (Attachment A).
- Fully submerge the slug bar or bailer into the water column of the well.
- The water level in the well should be allowed to return to static condition after both the slug and transducer have been inserted. The transducer readout on the PC or Rugged Reader should indicate the height of water above the transducer.
- When the water level in the well has returned to static condition, the transducer should be started ("Start Test" if using Win Situ software). Periodically view graphical data on PC or Rugged Reader during test, to confirm adequate data collection.
- Rapidly remove the slug bar or bailer from the water column and well. Avoid moving or pulling up the transducer cable with the slug.
- The transducer should continue to record water levels until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until one hour has elapsed.
- Data stored in the transducer should be transferred to and stored on the project directory for analysis.

2.3 Field Procedure – Falling Head Test

- Log the initial water level on the attached form.
- The water level in the well should be allowed to return to static condition after the transducer has been inserted. The transducer readout on the PC or Rugged Reader will indicate the height of water above the transducer.

- When the water level in the well has returned to static condition, begin recording transducer readings ("Start Test" if using Win Situ software).
- Fully submerge the slug bar or bailer into the water column of the well.
- Periodically view graphical data on PC or Rugged Reader during test, to confirm adequate data collection. The transducer should continue to record water levels until the water level has recovered to within 15 percent of the original static water level relative to the initial test displacement (85 percent recovery), or until one hour has elapsed.
- Data stored in the transducer should be transferred to and stored on a portable computer for analysis.

3. Quality Control

The time required for a slug test to be completed is a function of the volume of the slug, the hydraulic conductivity of the formation, and the type of well completion. The slug volume should be large enough that a sufficient number of water level measurements can be made before the water level returns to equilibrium conditions. Two bailers connected in series can be used to increase the slug volume, provided the water column is deep enough.

If the well is to be used as a monitoring well, precautions should be taken that the wells are not contaminated by material introduced into the well.

Heavy contamination such as NAPL will damage the transducer. Gauge recovery manually in these instances.

Where possible, take periodic water level readings manually during recovery. The manual data can be used for calculations, if needed, to correct for transducer noise or movement.

Where possible, take more than one pressure transducer to site. This will provide backup and allow testing of multiple wells simultaneously.

4. Calculations

The simplest interpretations of piezometer recovery are that of Hvorslev (1951) and Bouwer and Rice (1976). The analyses assume a homogenous, isotropic medium in which soil and water are incompressible. Spreadsheets and software are available to calculate hydraulic conductivity from slug test data according to the methods below.

Hvorslev's expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln (L/R)}{2 L T_0} \qquad for\ L/R > 8$$

where:
K = hydraulic conductivity [ft/sec]
r = casing radius [ft]
L = length of open screen (or borehole) [ft]
R = filter pack (borehole) radius [ft]
T_0 = Basic Time Lag [sec]; value of t on semi-logarithmic plot of H-h/H-H_0 vs. t, where H-h/H-H = 0.37 $_0$
H = initial water level prior to removal of slug
H_0 = water level at t = 0
h = recorded water level at t > 0

(Hvorslev, 1951; Freeze and Cherry, 1979)

The Bouwer-Rice expression for hydraulic conductivity (K) is:

$$K = \frac{r^2 \ln (R_e/R) \ln(h_o/h_t)}{2 L t}$$

where:
r = casing radius [ft]
t = time of drawdown measurement since start of test [sec]
h = drawdown of water in well at time = t [ft]
h_o = drawdown of water in well at t = 0 (initial drawdown) [ft]
L = length of open screen (or borehole) [ft]
R_e = effective radius (radius of influence) [ft]
R = gravel pack radius [ft]

Both the Hvorslev and Bouwer-Rice methods can be applied for partially-penetrating wells. Hvorslev is generally applicable only to fully penetrating wells.

5. References

U. S. EPA ENVIRONMENTAL RESPONSE TEAM STANDARD OPERATING PROCEDURES SOP: 2043,"Water Level Measurement" REV: 0.0, 10/03/94.

U. S. EPA ENVIRONMENTAL RESPONSE TEAM STANDARD OPERATING PROCEDURES SOP: 2046,"Slug Tests" REV: 0.0, 10/03/94.

Hvorslev, M.J., "Time Lag and Soil Permeability In Ground-water Observations," U.S. Army Corps of Engrs. Waterways Experiment Station Bulletin No. 36, 1951.

Bouwer, H., "The Bouwer and Rice Slug Test – An Update," Ground Water, vol. 27(3), 304, 1989.

Freeze, R. Allen and John A. Cherry, 1979. Groundwater, Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Butler, James J., Jr., "The Design, Performance, and Analysis of Slug Tests", Kansas Geological Survey, Lewis Publishers, 1997.

Butler, James, J., Jr. "Improving the Quality of Parameter Estimates Obtained from Slug Tests", Ground Water, Vol. 34, No. 3, May-June 1996.

Sanders, Laura L., "A Manual of Field Hydrogeology", Prentice-Hall, Inc., 1998.

6. Attachments

Attachment A – Slug Test Data Form

Attachment A

Attachment A. Slug Test Data Form

SITE ID: _____ SLUG TYPE (solid/bailer/pumped)

LOCATION/WELL ID _____ SLUG DIAMETER: _____

DATE: _____ SLUG LENGTH: _____

FIELD PERSONNEL: _____ METHOD:

_____ RISING HEAD _____

DATALOGGER TYPE: FALLING HEAD _____

_____

_____

COMMENTS:

_____

_____

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SETUP

Time _____

Depth to Water - Initial Static (before installing troll/slug) _____

Confirm well recovers to static after installing slug, or note otherwise

_____

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MANUAL CONFIRMATORY MEASUREMENTS

ELAPSED TIME (min.)	DTW	ELAPSED TIME	DTW
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Form based on:
USEPA, 1994; Sanders, 1998.

STANDARD OPERATING PROCEDURE

GW-011 Open Standpipe Piezometer Construction and Installation

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the installation of open standpipe piezometers for geotechnical evaluations. This SOP assumes the piezometers will be constructed from threaded, flush-joint polyvinyl chloride (PVC) pipe; the piezometer tip will either be constructed from a factory-slotted pipe or a porous stone. Piezometer dimensions (riser diameter, riser length, piezometer tip length, and slot-diameters for screened tip or pore size for porous tips) and filter sand gradation will be specified in the Work Plan.

2. Execution

All measurements taken during the installation are to be recorded on the GEI Open Standpipe Piezometer Installation Report Form.

- Using a weighted tape, measure and record the depth of the completed soil boring before beginning the piezometer installation.
- Measure the depth to groundwater in the borehole over a 10 to 15 minute period to observe that the groundwater elevation has approximately stabilized. Compare the saturated soil depth estimated from split-spoon samples to the measured water level in the borehole.
- Choose the riser length so that the piezometer tip (slotted section or porous stone) is located in the appropriate zone as specified in the Work Plan or determined by the Project Manager (PM) or their designee.
- If the borehole is deeper than the desired piezometer depth, then fill the base of the borehole with sand. Pour at least 12 inches of clean filter sand into the borehole. As sand is added to the borehole, slowly extract the casing or augers to maintain the sand level at or near the bottom of the casing or augers. The bottom of the casing or augers should not extend more than 6 inches above the top of the filter sand at any time. Allow the filter sand enough time to settle. Measure and record the depth to the top of the filter sand to the nearest 0.1 foot.
- Assemble the piezometer including the riser, screen, silt trap, etc. Install and secure a bottom cap. The bottom cap should be secured with either a threaded coupling and/or stainless steel screws.
- Temporarily cover the top of the riser pipe and lower the complete piezometer plus riser into the borehole allowing the base to rest on the filter sand placed previously. Make sure that the piezometer is centered in the borehole.
- Pour sand around the piezometer, frequently checking the depth to confirm that the sand is not bridging. As sand is added to the

borehole, slowly extract the casing or augers to maintain the sand level at or near the bottom of the casing or augers. The bottom of the casing or augers should not extend more than 6 inches above the top of the filter sand at any time.

- Add enough filter sand to fill the annulus between the piezometer and the borehole to a height of approximately 2 feet above the top of the slotted or porous section of the piezometer tip. Record the depth to the top of the filter sand to the nearest 0.1 foot.
- Slowly pour bentonite chips into the annulus between the piezometer riser and the borehole. As bentonite is added to the borehole, slowly extract the casing or augers to maintain the bentonite level at or near the bottom of the casing or augers. Frequently check the level of the bentonite in the borehole to ensure that the bentonite is not bridging.
- Place bentonite to form a minimum 3-foot-thick seal above the filter sand pack. Record the depths to the top and bottom of the bentonite seal to the nearest 0.1 foot. If the seal extends above the water table, use at least 5 gallons of potable water to hydrate the bentonite.
- Before removing the casing or augers, lower a tremie pipe to the bottom of the borehole, and begin to pump bentonite-cement grout into the borehole. Grout should be mixed in approximately the following proportions: 7.5 gallons water to one 94-pound bag of cement to 2-4 pounds of pulverized bentonite. The grout must be mixed using the pump on the rig to ensure proper mixing.
- As grout is added to the borehole, slowly extract the casing or augers to maintain the grout level at or near the bottom of the casing or augers. The bottom of the casing or augers should not extend more than 6 inches above the top of the grout at any time.
- Continue pumping grout to fill the borehole. The driller should use caution to ensure that grout does not enter the piezometer riser. Protective surface casing will consist of either a flush-mounted road box or a steel guard pipe. If a road box is to be used for surface casing, measure the length of the road box. Fill the grout so that the level reaches 4 to 6 inches below the bottom of the roadbox length. Fill the annular space with filter sand for drainage.
- If a steel guard pipe is used as protective casing, place the protective surface casing in the grout before it sets. The base of the guard pipe must extend at least 3.5 feet below the ground surface (below the frost line), and have a stick-up of no more than 3 feet above the ground surface.
- Cut the piezometer riser flat and place a mark or "V"-notch or an arrow on the casing with an indelible marker at one point for surveying and groundwater measurements. Cut the riser so that the top of the riser is 3 to 6 inches below the top of the protective casing.

- In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the road box flush with the ground surface to avoid damage to the piezometer. Additional protection such as steel pole bumpers around the guard pipe may be necessary.
- Place a vented, locking cap on the piezometer pipe.
- All piezometer locations should be photo documented in accordance with SOP FD-004, *Photo documentation*.
- Label the protective casing with a paint pen and tape out the location to nearby landmarks so that the piezometer may be located in the future. Make sure to enter this information in the field notebook. If possible, place a brightly colored stake or other identifier adjacent to the piezometer.
- Develop the piezometer (see SOP DM-009, *Monitoring Well Development*).

3. Notes

- If drilling mud is used to advance the borehole, the drilling mud MUST be Revert or other biodegradable drilling mud approved by the PM.
- At all times, follow safety procedures as defined in the site-specific Health and and Safety Plan.
- Site-specific conditions must be evaluated to determine appropriate materials.
- Do not screen across different hydrostratigraphic units if possible (for example, outwash sands and till) unless specified in the Work Plan or approved by the PM.
- If the formation is composed of a material that is uniformly coarser than the filter sand, the grain size of the filter sand must be increased. Consideration should also be given to changing the slot size on the well screen. Differences in average grain size should generally not be greater than a factor of two to four times. Gradation of filter sand used is to be reviewed and approved by the PM or their designee.
- Do not use borehole/auger cuttings for backfill during monitoring well installation. If the cuttings are suspected to contain contamination which was identified during drilling, cuttings are to be containerized for later characterization and not used for filter pack materials.
- Do not screen across a confining layer (e.g., silt or clay). Backfill all confining layers with hydrated bentonite or grout.

4. References

Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers (October 1990), American Society for Testing and Materials [ASTM] D5092-90.

Nielsen, D.M. (1993), "Correct Well Design Improves Monitoring," Environmental Protection, July, pp. 38-49.

STANDARD OPERATING PROCEDURE

GW-012 Vibrating Wire Piezometer Construction and Installation

1. Objective

The objective of this standard operating procedure (SOP) is to standardize the installation of vibrating wire piezometers for geotechnical evaluations. This SOP assumes the piezometers will be supplied by the manufacturer ready for installation and accompanied by factory calibration data. Piezometer details (installation depth and cable length) will be specified in the Work Plan.

2. Execution

- All measurements taken during the installation, including the manufacturer's serial number and calibration data are to be recorded on Attachment B, Well Construction Form.
- Using a weighted tape, measure and record the depth of the completed soil boring before beginning the piezometer installation.
- Measure the length of the cable required to set the piezometer tip at the depth specified in the Work Plan or determined by the Project Manager (PM) or their designee. Make a mark on the cable with a permanent marker or electrical tape at a distance from the piezometer tip equal to the planned installation depth. Record the distance from the piezometer tip to the mark to the nearest 0.05 feet. This mark should line up with the top of the borehole when the piezometer tip is lowered to the correct depth. Place an additional mark 5 feet above the initial mark. The additional mark can be used to determine the final piezometer depth in the event that the first mark becomes obscured.
- Place the piezometer in a piece of slotted polyvinyl chloride (PVC) pipe or a porous filter bag filled with filter sand, and attach the PVC or bag to the piezometer cable. This will aid in removing slack from the instrument cable during installation.
- If the borehole is deeper than the bottom of the desired sand filter zone depth, slowly fill the borehole with bentonite chips to a depth of approximately 2 feet below the planned piezometer tip elevation. Take a borehole depth measurement after adding bentonite to make sure the bentonite did not bridge.
- Slowly raise the casing or augers and simultaneously pour clean filter sand in the borehole to maintain the level of the filter sand near the bottom of the casing or augers. The bottom of the casing or augers should not be raised more than 6 inches above the top of the filter sand at any point during the installation.
- Continue placing sand until the level of the sand is approximately 6 inches below the planned piezometer tip elevation.

- Lower the piezometer into the borehole to a point just above the water level in the casing, and allow the piezometer to stabilize thermally. Thermal stabilization usually takes about five to 15 minutes. Thermal stabilization is assumed to have occurred once the piezometer reading has stopped changing while the piezometer is suspended in the borehole.
- Obtain the initial zero reading from the piezometer using a read-out box. Record the zero reading and the temperature reading. If the read-out box does not have a temperature read-out, use an ohm meter to measure the resistance across the thermistor. This resistance can be converted to a temperature reading. Compare the measured zero reading to the factory zero reading. The zero reading should be within 20 digits of the factory zero reading after barometric and temperature corrections are made.
- Lower the piezometer in the borehole to the planned installation depth, and allow the piezometer to thermally stabilize for 15 to 20 minutes.
- Measure the depth to the water level in the borehole using a water level indicator, determine the height of the water column above the piezometer tip, and estimate the water pressure at the piezometer tip (height of water column times the unit weight of water). Record the measured water level and estimated water pressure.
- Take a piezometer reading to verify that the vibrating wire piezometer is reading correctly. Calculate the temperature-corrected pressure head. Record the piezometer reading, temperature, and pressure head. The piezometer is reading correctly if the measured pressure head approximately equals the estimated water pressure at the piezometer tip, calculated based on the measured water level. The piezometer reading should be within 0.5% of the estimated water pressure.
- Raise the piezometer 5 to10 feet, measure the water level in the borehole, and calculate the water pressure at the piezometer tip. Take a piezometer reading, and calculate the temperature-corrected pressure head. Record the piezometer reading, temperature, and pressure head. Compare the pressure head from the piezometer with the estimated water pressure. Again, the piezometer reading should be within 0.5% of the estimated water pressure.
- Lower the piezometer tip back to the planned installation depth, measure the water level in the borehole, and calculate the water pressure at the piezometer tip. Take a piezometer reading, and calculate the temperature-corrected pressure head. Record the piezometer reading, temperature, and pressure head. Compare the pressure head from the piezometer with the estimated water pressure. Again, the piezometer reading should be within 0.5% of the estimated water pressure.

- Tie off the piezometer cable to prevent the cable from falling into the borehole while the casing or augers are removed. The cable should be kept free of slack during the casing or auger removal and backfilling of the borehole.
- Remove the drill casing or augers from the borehole slowly at a maximum of 6-inch intervals. As the casing or augers are raised, the driller should slowly add filter sand to maintain the level of the filter sand near the bottom of the casing or augers. As the driller pours the sand into the borehole, take frequent measurements of the depth to the top of the sand. Do not let the sand "bridge" in the borehole.
- Using the marks placed on the cable at the start of the installation, confirm that the piezometer is installed to the correct depth.
- Continue slowly removing the casing or augers and slowly add adequate filter sand to surround the piezometer and fill the borehole to a height of approximately 2 feet above the piezometer tip and record the depth to the nearest 0.1 foot.
- Confirm that the piezometer is installed to the correct depth.
- Measure the water level in the borehole.
- Place at least 3 feet of bentonite chips above the filter pack to create a seal. Record the depths of the top and bottom of the bentonite seal to the nearest 0.1 foot.
- Before removing the drill casing or augers from the borehole, lower a tremie pipe to the bottom of the borehole, and pump bentonite-cement grout through the tremie pipe until good quality, undiluted grout return is observed at the ground surface. Grout should be mixed in approximately the following proportions: 7.5 gallons of water to one 94-pound bag of cement to 2-4 pounds of pulverized bentonite. The grout must be mixed using the pump on the drill rig or other high shear mixer to ensure proper mixing.
- After grouting the borehole and removing the drill casing or augers, place the protective surface casing in the grout before it sets. The protective surface casing will be either a flush-mounted road box or a steel guard pipe. If a steel guard pipe is used, the base of the guard pipe must extend at least 3.5 feet below the ground surface (below the frost line), and have a stick-up of no more than 3 feet above the ground surface.
- Confirm that the piezometer is installed to the correct depth.
- Record a second set of readings to verify that the piezometer continues to operate as expected. Coil any excess cable inside the protective surface casing. The cable must be accessible from the top of the protective surface casing.
- Place concrete in the annular space between the protective casing and the borehole up to the ground surface. Slope the concrete radially away from the protective casing at the ground surface to promote

surface water runoff. In areas of high traffic or areas of parking lots and/or roadways where plowing occurs, set the road box FLUSH with the ground surface to avoid damage to the road box.

- If the piezometer is installed in a high-traffic area with a guard pipe, additional protection such as steel pole bumpers around the guard pipe may be necessary.
- All piezometer locations should be photo documented in accordance with SOP FD-004, *Photo Documentation*.
- Label the protective surface casing with a paint pen and tape out the location to nearby landmarks so that the piezometer may be located in the future. Enter this information in the field notebook. If possible, place a brightly colored stake or other identifier adjacent to the surface casing.

3. Notes

- At all times, follow safety procedures as defined in the site-specific Health and Safety Plan.
- Site-specific conditions must be evaluated to determine appropriate materials.
- The gradation of the filter sand should be selected based on the gradation of the formation material. The gradation of the filter sand is to be reviewed and approved by the PM or their designee.
- Do not use drill cuttings for backfill during piezometer installation. If the cuttings are suspected to contain contamination which was identified during drilling, cuttings are to be containerized for later characterization.

4. References

Dunnicliff, J. (1988), Geotechnical Instrumentation for Monitoring Field Performance,John Wiley and Sons, Inc.

Instruction Manual, Model 4500 Vibrating Wire Piezometer (2005), Geokon, Inc.

5. Attachments

Attachment A - GEI Pressure Calculation and Temperature Correction Sheet

Attachment B - Well Construction Form

Pressure calculation and Temperature correction Sheet

Vibrating Wire Piezometer

Pressure = (Initial Reading – Current Reading) x Linear Gage Factor

Or

$P = (R_0 - R_1) \times G$

Temperature Correction = (Current Temp. – Initial Temp.) x Thermal Factor

Or

$P_T = (T_1 - T_0) \times K$

Corrected Pressure = Pressure + Temperature Correction

Or

$P_{corrected} = ((R_0 - R_1) \times G) + ((T_1 - T_0) \times K)$

1	2	3

Note: If the Linear Gage Factor with the units of psi/digit and the Thermal Factor with the units of psi/°C are used, the calculated pressures will be in units of psi. To convert from psi to feet of water, multiply by 144 and divide by 62.4.

Estimated water pressure at piezometer tip = height of water above tip x unit wt. of water
Unit weight of water = 62.4 lb/ft^3

Note: The height of water must be in units of feet. The water pressure will be in units of feet of water.

Calculation Results:

1.) Initial Calculation – Planned installation depth:

Temperature-corrected pressure head: _____

Estimated water pressure at piezometer tip: _____

2.) Second Calculation – Raise piezometer 5 to 10 feet:

Temperature-corrected pressure head: _____

Estimated water pressure at piezometer tip: _____

3.) Third Calculation – Lower piezometer back to planned installation depth:

Temperature-corrected pressure head: _____

Estimated water pressure at piezometer tip: _____

Section 8

Surface Water Sampling (SW)

STANDARD OPERATING PROCEDURE

SW-001 Surface Water Sampling

1. Objective

This Standard Operating Procedure (SOP) is applicable to the collection of representative surface water samples from streams, rivers, lakes, ponds, lagoons, and surface impoundments. It includes samples collected from depth as well as samples collected from the surface. These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations, or limitations imposed by the procedure. Location, equipment, and sampling situations will dictate the applicable method of sample collection for each point. Representative surface water samples will be collected from one of these four techniques.

- Kemmerer bottle
- Van Dorn sampler
- Direct method
- Peristaltic pump

2. Materials

Equipment needed for collection of surface water samples may include (depending on technique chosen):

- Kemmerer bottles
- Van Dorn sampler
- Line and messengers
- Peristaltic pump
- Teflon™/polyethylene tubing
- 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
- Survey stakes, flags, or buoys and anchors
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent marker
- Sample bottle labels
- Paper towels

- Secchi Disk – Illustration provided as Figure 1
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS) survey equipment

3. Execution

3.1. Pre-Sampling Procedures

Ensure that all samples are collected using adequate protective clothing and safeguards in accordance with the site-specific Health and Safety Plan (HASP).

3.1.1. Sample Location

A GPS navigation system, or a location map with field measured points if GPS is not available, will be used to identify and record sample location coordinates. If required, the proposed locations may be adjusted based on sample location access and obstructions.

3.1.2. Water Quality Data

Water quality data will be collected during sampling from the sample depth interval using an appropriate instrument to measure pH, specific conductance (SC), temperature, turbidity, dissolved oxygen (DO), and oxidation-reduction potential (ORP). In addition, water clarity will be measured at each sample location using a Secchi Disk. The water quality meter will be calibrated daily in accordance with manufacturer's specifications.

3.2. Sample Collection

3.2.1. Kemmerer Bottle

A Kemmerer bottle will be used in most situations to collect representative samples at the specific depths that are required. A picture of the Kemmerer bottle is provided as Figure 2. Sampling procedures are as follows:

- Prior to sample collection, the Kemmerer bottle will be properly decontaminated. The sampling device will be set so that the upper and lower stoppers are pulled away from the body of the sampler, allowing the surface water to enter tube.
- Lower the pre-set sampling device to the predetermined depth while avoiding disturbance of the bottom sediments.
- When the Kemmerer bottle is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.
- Retrieve the sampler and discharge the first 10-20 milliliters (ml) from the drain to clear potential contamination from the valve.
- This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

3.2.2. Van Dorn Sampler

A Van Dorn sampler will be used to collect surface water from a very specific sampling depth or from a shallow water body. A picture of the Van Dorn sampler is provided as Figure 3. Since the sampler is suspended horizontally, the depth interval sampled is the diameter of the sampling tube. The sampling procedure is as follows:

- Prior to sample collection, the Van Dorn Sampler will be properly decontaminated. The sampling device will be set so that the end stoppers are pulled away from the body allowing surface water to enter the tube.
- Lower the pre-set sampling device to the predetermined depth. Avoid disturbance of the bottom.
- When the Van Dorn Sampler is at the required depth, send the weighted messenger down the suspension line, closing the sampling device.
- Retrieve the sampler and discharge the first 10-20 ml from the drain to clear potential contamination from the valve.
- This procedure may be repeated if additional sample volume is needed to fulfill analytical requirements. Subsequent grabs may be composited or transferred directly to appropriate sample containers.

3.2.3. Direct Method

For surface water samples collected within the top 6-inches of the water column, the direct method will be utilized to collect water samples directly into unpreserved the sample container(s).

- Analytical samples that require field preservation will be transferred from the unpreserved container to a laboratory pre-preserved sampling container.
- Samples will be collected in a downstream to upstream direction. In shallow locations, collect the sample under the water surface while pointing the sample container upstream; the container must be upstream of the collector.
- Avoid disturbing the sediment surface during collection. The sample container will be held below the surface to avoid the collection of floating debris.

3.2.4. Peristaltic Pump

A peristaltic pump will be used to collect surface water from a very specific sampling depth or from a remote location that cannot be accessed with other sampling methods. Since the tubing can be weighted and suspended vertically, the depth interval sampled is the opening of the sampling tubing. The sampling procedure is as follows:

- Prior to sample collection, the tubing weights will be thoroughly decontaminated. Clean, disposable Teflon™ or polyethylene tubing will be cut to the predetermined sampling depth. The outside of the tubing will be marked with appropriate gradations to determine actual sample depth. The tubing will be affixed to an YSI, *In-situ* Troll 9000 or similar water quality meter to ensure water quality measurements are representative of the sample interval conditions.
- Lower the tubing and water quality meter to the predetermined sample depth. Avoid disturbance of the bottom.
- When the tubing is at the required depth, turn on the peristaltic pump.
- Discharge the two submerged tubing volumes from the pump to obtain a representative surface water sample.

3.2.5. 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.

- 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 SOP QA-001, *Equipment Decontamination*.
- Improper Sample Collection: Typical improper sample collection techniques include:
    i. Improper decontamination of sampling equipment.
    ii. Use of sampling equipment or sample containers that are not compatible with the contaminants of concern or the laboratory analytical method.
    iii. Excess sediment in the sample due to disturbance of the sediments by sampling equipment.
    iv. Sample collection in an obviously disturbed or non-representative area.
    v. Sample collection during a period of increased surface water velocity that causes significant re-suspension of sediments (i.e., tidal influences, storm surge).

3.2.6. Quality Assurance/Quality Control (QA/QC)

QA/QC procedures that may apply to the these activities include QA/QC laboratory samples including blind duplicate, matrix spike and matrix spike duplicate (MS/MSD) samples, and field blank samples. QA/QC samples may be detailed in the Work Plan and the Draft Quality Assurance Project Plan (QAPP). Prior to collection of the QA/QC samples, equipment will be

decontaminated in accordance with procedures described in SOP QA-001, *Equipment Decontamination*.

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 as indicated in the QAPP.

4. References

Wilde, F.D., D.B. Radtke, J. Gibs and R.T. Iwatsubo. 1998. National Field Manual for the Collection of Water-Quality Data – Selection of Equipment for Water Sampling. U.S. Geological Survey Techniques of Water – Resources Investigations, Book 9, Chap. A2, variously paged.
http://water.usgs.gov/owq/FieldManual/index.html and
http://water.usgs.gov/owq/FieldManual/mastererrat.html

U.S. Environmental Protection Agency. 1984. Characterization of Hazardous Waste Sites – A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA/600/4-84-076.

U.S. Environmental Protection Agency. 2002. U.S. EPA Environmental Response Team, Standard Operating Procedures #2013, Surface Water Sampling. EPA, 12/17/02.

5. Attachments

Figures 1, 2, and 3

Figures

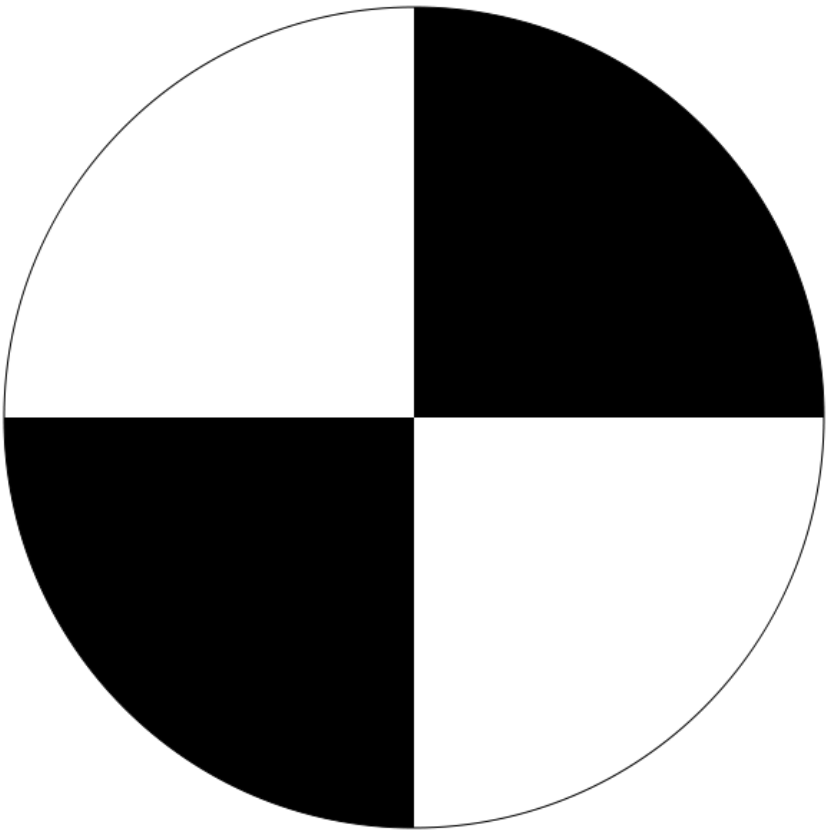

Figure 1 - Secchi Disk

Figure 2 – Kemmerer Bottle

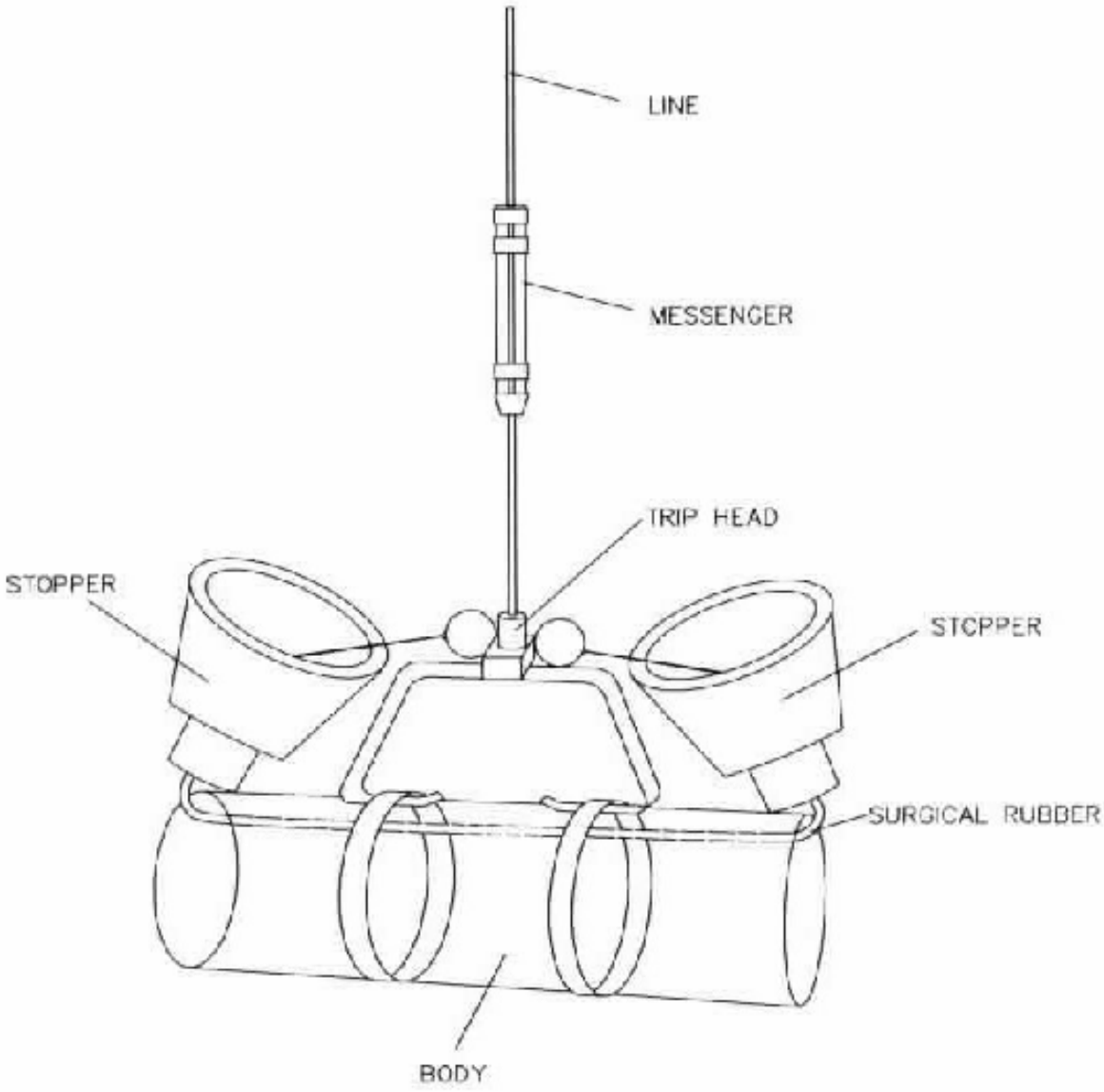

Figure 3 - Van Doran Sampler

Section 9

SEDIMENT SAMPLING (SS)

SUMMARY GUIDANCE

SS-001 Water Safety

1. Objective

The safe deployment and return of personnel during field activities while aboard a boat.

2. Execution

Boat safety practices will be conducted in general accordance with guidance provided in the United States Army Corps of Engineers (USACE) Safety and Health Requirements Manual (EM) 385-1-1. Personnel will board the boat at specified locations to be determined and agreed upon prior to field deployment. The following safety practices shall be adhered to:

- Every employee shall wear a Personal Flotation Device (PFD) at all times when underway aboard any boat less than 25 feet except when that boat is equipped with a fully enclosed cabin and the employee is inside. Boats under 25 feet must also, at a minimum, have Coast Guard approved PFDs on board for each person and at least one throwable flotation device, such as a seat cushion.
- For every boating activity, a trip plan must be filed with on-shore project personnel who will take appropriate action if personnel on the boat do not return as planned.
- Daily voice-radio communications with an appropriate base must be maintained.
- The consumption of alcoholic beverages and the use of illegal drugs shall not be permitted at any time aboard boats.
- Firearms shall not be kept in a loaded condition except when carried by law enforcement personnel.
- Contractors working in an exposed marine location shall monitor the National Oceanic and Atmospheric Administration (NOAA) marine weather broadcasts and shall use other local commercial weather forecasting services as may be available.
- For retrieving a person overboard, the boat operator will throw a life ring and line. For retrieving a person overboard, the support boat will also be equipped with a life ring attached to approximately 90 feet of rope. The support boat will be equipped with an ABC rated fire extinguisher(s).
- Emergency procedures for fire and man overboard will be reviewed on the first day of operations and any time a change of personnel occurs.

3. References

United States Army Corps of Engineers, Safety and Health Requirements Manual (EM), 385-1-1.November 3, 2003 – Section 19 Floating Plant and Marine Activities.

STANDARD OPERATING PROCEDURE

SS-002 Ponar or Shipek Grab Sampler

1. Objective

Surficial sediment samples will be collected from the upper 6 inches (approximate) using a Ponar or Shipek type grab sampler. These devices are relatively easy to handle and operate, readily available, moderately priced, and versatile in terms of the range of substrate types they can effectively sample. Both samplers provide sufficient sample volume (7.5 or 3 cubic liters, respectively) to allow sub-sampling for multiple analytes.

2. Materials

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Ponar/Shipek Sampler
- 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
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS)

3. Execution

- Prior to sample collection, the grab sampler will be decontaminated.
- When deploying the grab sampler, the speed of descent should be controlled, with no “free fall” allowed. In deep waters, use of a winching system is recommended to control both the rate of descent and ascent.
- The sampler will be carefully lowered the last few feet to minimize dispersal of fine material due to a sampler-induced shock wave.

- At the time of the sample collection, the sample location will be surveyed with GPS survey equipment.
- After the sample is collected, the sampling device should be lifted slowly off the bottom and raised to the surface at a slow and steady rate.
- Prior to sampling directly from the grab sampler, the overlying water will be removed by opening the jaws of the Ponar slightly and allowing the water to drain. If the overlying water is turbid, then the suspended solids will be allowed to settle, if possible, prior to draining.
- Where sampling directly from the sampler is not possible or feasible, the sampler will be slowly opened over a sample platform. The sampler will be placed such that the sample may be deposited with minimal disturbance.
- Photograph the sample in color with a digital camera. SOP FD-004, *Photo Documentation* provides further guidance on photo documentation.
- Sediments will be described in accordance with the soil description procedure listed below in SOP SM-003, *Soil Classification*, if necessary.
- Place sediment samples into pre-cleaned laboratory provided jars for the appropriate analyses as determined in the Work Plan. Label each jar with the unique grab sample identification number and depth of the sample.
- Place the sample containers into plastic sealable bags or bubble wrap and place them in an iced cooler until transfer shipment to the analytical laboratories. Add the sample to the chain of custody form.

4. References

U.S. Environmental Protection Agency, Office of Water, Office of Science & Technology. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823B-01-002, October 2001.

State of Ohio, Environmental Protection Agency, Division of Surface Water. 2001. Sediment Sampling Guide and Methodologies, Second Edition. November 2001.

ASTM, 2003. D4823-95 (2003) Standard Guide for Core Sampling Submerged, Unconsolidated Sediments. ASTM International, West Conshohocken, PA. August 2003.

Newfield's Environmental Forensics Laboratory, 2005. Geochronologic Sample Handling Procedure.

STANDARD OPERATING PROCEDURE

SS-003 Sediment Sampling Using Vibracore Equipment

1. Objective

Fine-grained sediments, such as sands, silts and clays can be collected using Vibracore (VC) equipment for depths of up to 10 feet below the top of sediments. The VC equipment utilizes an air powered piston vibrator to drive the core pipe into the unconsolidated sediments. A disposable lexan liner is placed within the core pipe to collect each sample. A new liner is inserted in the core pipe for each sample.

2. Materials

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Vibracore sampler
- 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
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS)

3. Execution

- Sample from downstream to upstream locations so that disturbed sediment will not affect subsequent sampling locations.
- If sediment samples are being collected for laboratory analysis, the sampling equipment (i.e., cutting shoe, retainer, and sampling barrel) shall be decontaminated prior to the collection of samples at each location. Decontamination shall be conducted according to procedures that are outlined in any work plan(s) associated with the site.

- The drilling contractor shall measure the depth of the water column (depth to top of sediments). The drilling contractor shall also record the latitude, longitude, and elevation of the sample location by means of the GPS. This information will be recorded by the GEI field representative along with a written description of the location (including sketch if appropriate). If GPS is not available, sampling locations will be marked with a labeled stake, buoy, flagging, or other device. When marking locations in navigable waterways, the appropriate regulatory agencies will be informed and proper precautions will be taken to prevent any navigational hazards before, during, and after sampling.
- Prior to coring at each sampling location, the VC watercraft shall be moored in a multi-point fashion.
- The VC drilling contractor will collect sediment samples using 3-inch diameter steel pipe in lengths of 5-feet or 10-feet. A 2-5/16-inch outer diameter (1/16-inch thick) lexan liner is placed into the core barrel. The apparatus is vibrated into the sediments, where penetration rates will vary depending on the sediment type. When the projected/ specified depth is reached, the core will be retrieved.
- If sufficient room on the VC watercraft is available, the GEI field representative will log the core and collect analytical samples from the core onboard. Otherwise, core samples shall be delivered to the field representative at a shore side landing area as soon as practical after acquisition.
- The GEI field representative will identify and record the recovery and the type of sediment in terms of the major and minor constituents (i.e., sand, gravel, silt, and clay) and choose the proper group name and Unified Soil Classification Symbol (USCS). Standard Operating Procedure (SOP) SM-003, *Soil Classification*, provides further guidance on GEI's soil classification and description methodology. Sediment samples shall be described according to the American Society for Testing and Materials (ASTM) Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) D2488-90. Estimates of the percentage of each constituent will be recorded and listed in order of predominance.
- The sample structure shall be recorded (i.e., laminated, stratified, homogenous). Note attributes such as cementation, color and mineralogy (if it can be determined).
- Screening for Volatile Organic Compounds (VOCs) will be conducted on sediments throughout the core. A photoionization detector will be used for this process. Only relatively undisturbed portions of the core will be screened. The results of the screening will be recorded. Screening should be performed in accordance with SOP SC-004, *Head Space VOC Screening*.

- The presence of iron-staining, or other staining, presence of organic matter, shells, debris or detritus will be recorded. Any odors (i.e., tar-like vs. gasoline-like vs. fuel oil-like, etc.) will be recorded. Any visual impacts will be recorded (i.e., sheens vs. dense non-aqueous phase liquid [DNAPL] vs. staining vs. oil blebs).
- Analytical samples will be selected based on any criteria stipulated in the associated site-specific work plan. Analytical samples shall be collected with stainless steel spatulas (or similar) that have been decontaminated according to QA-001. The samples shall be contained in laboratory provided jars or glassware and kept cool. The sample identification, date, time, and associated details will be recorded. Pertinent information regarding the samples will be recorded on a chain of custody form.

4. References

Annual Book of ASTM Standards (1993), Section 4, v. 4.08 Soil and Rock; Building Stones; Geosynthetics, D2488-90, Standard Practice for Description and Indentification of Soils (Visual-Manual Procedure), American Society for Testing and Materials (ASTM).

STANDARD OPERATING PROCEDURE

SS-004 Remote Sediment Sampling

1. Objective

A remote sampler will be used to collect surficial sediment samples at shallow depths where either Ponar / Shipek or Vibracore methods are inaccessible.

2. Materials

Equipment needed for collection of sediment samples may include (depending on technique chosen):

- Remote sampler (stainless steel or Teflon scoop attached to a telescoping pole or other similar device)
- 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
- Camera
- Field data sheets/field notebook/waterproof pen
- Permanent markers
- Sample bottle labels
- Paper towels
- Personal Protection Equipment (PPE)
- Global Positioning System (GPS)

3. Execution

- Prior to sample collection, the remote sampler will be thoroughly decontaminated.
- The remote sampler is extended to the location of the sediment sample targeted for collection.
- Once a sufficient volume of material is collected in the scoop, then the sampler should be retrieved slowly to avoid the loss of extremely fine material as the sampler passes through the water column.
- Photograph the sample in color with a camera. Standard Operating Procedure (SOP) FD-004, *Photo Documentation*, provides further guidance.

- Sediments will be described in accordance with the soil description procedure listed below in SOP SM-003, *Soil Classification*, if necessary.
- Place sediment samples into pre-cleaned laboratory provided jars for the appropriate analyses as determined in the work plan. Label each jar with the unique grab sample identification number and depth of the sample.
- Place the sample containers into plastic sealable bags or bubble wrap and place them in an iced cooler until transfer shipment to the analytical laboratories. Add sample to the chain of custody form.
- This process may be repeated if additional sample volume is necessary.

4. References

U.S. Environmental Protection Agency, Office of Water, Office of Science & Technology. 2001. Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual. EPA-823B-01-002, October 2001.

State of Ohio, Environmental Protection Agency, Division of Surface Water. 2001. Sediment Sampling Guide and Methodologies, Second Edition. November 2001.

ASTM, 2003. D4823-95 (2003) Standard Guide for Core Sampling Submerged, Unconsolidated Sediments. ASTM International, West Conshohocken, PA. August 2003.

Newfield's Environmental Forensics Laboratory, 2005. Geochronologic Sample Handling Procedure.

Section 10

AIR SAMPLING AND MONITORING (AR)

SUMMARY GUIDANCE

AR-001 General Guidance on Community Air Monitoring Methods

1. Objective

The purpose of a community air monitoring plan is to provide early detection in the field of potential short-term emissions in order to protect human health by measuring air quality at the perimeter of a work area.

Specifically, the objectives of a community air monitoring plan (CAMP) are to:

- Provide an early warning system to alert the contractor conducting ground-intrusive activity, GEI staff, New York State Department of Environmental Conservation (NYSDEC), and National Grid that concentrations of total volatile compounds (TVOC) or dust in ambient air are approaching Action Limits due to site activities.
- Provide potential contingency measures to be enacted by the contractors that are designed to reduce the off-site migration of contaminants if established Action Limits are approached or exceeded.
- Determine whether construction or engineering controls are effective in reducing ambient air concentrations to below Action Limits and make appropriate and necessary adjustments.
- Develop a permanent record that includes a database of perimeter air monitoring results, equipment maintenance, calibration records, and other pertinent information.

For reference, Appendix 1A, NYSDOH Generic Community Air Monitoring Plan, of the *New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation dated May 3, 2010*, has been included as Attachment A.

2. Execution

During ground-intrusive activities, perimeter air monitoring may be conducted using a combination of fixed-station, moveable tripod-mounted, and/or handheld air monitoring equipment (as appropriate). Monitoring will be performed for TVOC and dust along the site perimeter. Odor may also be monitored along the site perimeter.

Monitoring for TVOC and dust will be performed using real-time sampling equipment. TVOC concentrations will be monitored and recorded using an organic vapor analyzer and dust will be measured and recorded as respirable particulate matter less than 10 microns (PM-10) using a portable aerosol monitor equipped with a PM-10 impactor to measured dust. If tripod mounted

units are used, readings will be checked manually on a predetermined periodic basis. If a fixed-station system is used, readings will be recorded by a centralized data logger system station once per minute. Supplemental perimeter monitoring for TVOC, dust, and odor will occur along the perimeter of the project site on an as-needed basis using handheld equipment. Each approach is detailed below.

Fixed Station Monitoring

Real-time air monitoring for TVOCs and particulates will be conducted upwind and downwind of the work area along the Site perimeter during intrusive activities. Instruments will be positioned to monitor the vicinity around the active work zone based on a particular day's activities. Real-time monitors will continuously gather data. The air monitoring system consists of potentially several air monitoring stations, one meteorological tower, and one central computer system. The central computer system will be located in the project trailer or other appropriate work area.

The real-time fixed air monitoring stations will be positioned between the work zone and the largest number of potential off-site receptors. Therefore, the placement of the fixed air monitoring stations is based on the need to document all potential off-site migration on the perimeter, but also recognizes the potential off-site receptors and the location of the proposed construction activities.

Each real-time air monitoring station contains the following:

1. Station enclosure
2. An organic vapor analyzer
3. A particulate monitor
4. A radio telemetry device

Each monitoring station is housed in a weather-tight NEMA-4 type enclosure. Each monitoring station will continuously measure and record TVOC and dust at a rate of one sample per minute and calculate 15 minute time-weighted running averages.

In addition to the air monitoring stations, a Campbell Scientific, Inc. Met Data1 meteorological monitoring system, or equivalent, will be established onsite. The meteorological system will continuously monitor temperature, relative humidity, wind speed, and wind direction at a rate of one sample per minute and calculate 15 minute time-weighted running averages. Wind direction and wind speed will be displayed on the central computer in real-time to determine upwind and downwind stations for assessing Alert Level, Response Level, and Action Levels. Wind socks and/or flags will be placed at locations around the site, as necessary, to obtain real-time site-specific wind direction.

All TVOC, dust, and meteorological data will be stored in dataloggers located within each monitoring station. Stored analytical data along with system performance data from each station will be sent in real-time, via radio telemetry, to the Site central computer system for monitoring and analysis. In the event of severe weather or power loss at the site, data recording and/or recovery may be affected.

Tripod-Mounted Monitoring

Tripod mounted stations are a less intensive equipment option then fixed station monitoring during site investigations or remediation. Instruments will be positioned along the Site perimeter to monitor the air based on a particular day's ground intrusive activities, generally at up to three locations. Real-time monitors will continuously gather data during periods of intrusive activity during working hours. The equipment will be manually read on a predetermined periodic cycle during the work activity.

The readings will be collected at a minimum of 15-minute intervals during periods of intrusive activities. Wind direction will be determined by using a wind sock or flagging placed on a pole at the Site.

Each air monitoring station would include the following:

1. Station tripod and enclosure
2. An organic vapor analyzer
3. A particulate monitor

Each monitoring station will continuously measure and record TVOC and dust. All TVOC and dust data will be stored in dataloggers located within each monitoring station. Data from each piece of equipment will be downloaded daily at the completion of intrusive activities and stored on a central computer system. The location of each station, the work zone, and the wind direction will be noted daily. At each monitoring station location, the 15-minute average value of TVOC and dust will be recorded. The 15-minute average value of TVOC and dust data from the upwind and downwind station will be compared and resultant downwind concentration will be calculated and recorded.

Supplemental and Perimeter "Walk-Around" Monitoring

Supplemental "walk-around" perimeter monitoring for TVOC and PM-10 will occur along the perimeter of the project site on an as-needed basis using handheld equipment. Specific site conditions that may trigger walk-around perimeter monitoring include:

- Visible dust.
- Detection of TVOC or dust at an air monitoring station at concentrations exceeding an Alert Level, Response Level, and Action Levels.
- Direction by the construction manager, National Grid, or NYSDEC.

Fifteen-minute average TVOC and dust readings will be collected continuously at a downwind location between the work area and the nearest receptors.

When a triggering condition is observed during ground intrusive activity, the supplemental downwind perimeter monitoring will occur continuously until the conditions that triggered the monitoring have subsided.

Visible Dust

In addition to measured dust levels, the CAMP requires monitoring of visible dust conditions. If visible airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind dust levels do not exceed the Action Level concentration of 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

3. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

4. Attachments

Attachment A – NYSDOH Generic Community Air Monitoring Plan

Attachment A

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

STANDARD OPERATING PROCEDURE

AR-002 Perimeter Air Monitoring Method (Airlogics™ Classic/Lite Air Monitoring Station)

1. Objective

The main objective of this SOP is to protect human health by measuring air quality at the perimeter of a site area.

Perimeter air monitoring is typically required during invasive site activities such as drilling, excavation, and trenching. The two main types of perimeter air monitoring include monitoring utilizing fixed data collection points and monitoring utilizing mobile data collection points.

2. Materials

Based on the requirements of the site-specific work plan, one of the two monitoring station setups below may be utilized for perimeter air monitoring activities.

Classic Monitoring Station:

1. PhotoVac Gas Chromatograph (GC), or equivalent
2. Thermo MIE Data RAM 4000 (DR-4) real time aerosol monitoring, or equivalent

Lite Monitoring Station:

1. PhotoVac 20/20 Photo-ionization Detector (PID), or equivalent
2. Dust Trak aerosol monitor, or equivalent

3. Execution

Prior to any invasive site activities, perimeter air monitoring stations must be set up, properly calibrated, activated, and programmed for data logging.

Supplemental perimeter and walk-around monitoring for Total Volatile Organic Compounds (TVOC), Respirable Particulate matter less than 10 microns (PM-10), and odor may occur along the perimeter of the project site on a regular and as-needed basis. The use of supplemental air monitoring will be determined by the site-specific work plan. Specific site conditions that may trigger walk-around perimeter or work zone monitoring include:

- visible dust;
- odor complaints;
- detection of TVOCs and/or PM-10 at levels approaching or exceeding action levels; or
- direction by the site oversight consultant or client.

When a triggering condition is detected, the walk-around perimeter and work zone monitoring will occur continuously until the conditions that triggered the monitoring have subsided. Additional temporary monitoring points may be established due to changing site or meteorological conditions.

Perimeter air monitoring, in the absence of any specific triggering criteria, will be conducted on a regular basis 24 hours a day for large excavations, and during daily working hours for smaller intrusive activities (soil borings, well installations, etc.). Particular attention will be given to the direction of any residences.

Station Installation

- On receipt of the unit, inspect all containers to ensure that all components have been received and verify that the unit is operational.
- On site, assemble the unit according to AirLogic's instructions and manufacturer's specifications. Check all power cords and tubing for crimps, cracks, and breaks. The station should be placed on a sturdy platform or even ground level.
- The station should be strategically placed according to the work plan or objectives of the study and located free of any obstructions to ambient air flow.
- The Classic station requires 120 volt AC power. The electrical outlet should be protected by a ground fault interrupter and water proof electrical connectors should be used. The Lite station requires an unobstructed view for solar panels and will be angled appropriately for optimal solar power.
- Operate the sampler for 10 minutes to ensure that the motor is operating at full performance.
- Calibrate the station in accordance with the instructions provided with the instruments. Proper calibration of the unit is critical.
- Field personnel should be familiar with both the station and the calibration procedure before working on site.

Sampling Procedure

For Classic Stations:

DataRAM™:

Daily startup procedures for the DataRAM™ include zeroing and performing a span check on the instrument. Before startup, the DataRAM™ should be fully charged and the power selector switch on the rear panel should be in the "on" position.

All of the necessary attachments should be assembled prior to zeroing the DataRAM™. Attachments include the inlet heater, omnidirectional inlet, and PM2.5/PM10 impactor. Please consult the DataRAM™ instruction manual for details on use of the attachments.

Each MIE DataRAM™ is programmed to operate under the predetermined operating conditions as described in the appropriate Work Plan. (The MIE DataRAM™ is capable of monitoring total suspended particulate matter, particulate matter less than 10 microns [PM-10], and particulate matter less than 2.5 microns [PM-2.5]). The DataRAM™ can be programmed to collect continuous real-time data, or can collect "averaged" real-time data. These various options should be addressed prior to field operations and must be referenced in an approved work plan.

DataRAM™ calibration:

1. Press EXIT to get out of the current screen.
2. When Terminate Run is highlighted, hit ENTER.
3. In the MAIN MENU screen; go down to Zero/Intilize then hit ENTER.
4. After the DataRam™ finishes zeroing out it will read READY; then hit EXIT.
5. In the MAIN MENU, highlight START Test and press ENTER. This will restart the testing.

PhotoVAC GC Voyager calibration:

1. Hit Enter/Menu button to see the menu. Locate the log button; hit DELETE; hit ALL, then hit YES.
2. Hit Enter/Menu button; Select SETUP; Hit MODE; Hit AUTO cycle down to turn it off; hit ENTER then EXIT VOC-GC hit down to turn it off; hit ENTER then EXIT.
3. Unscrew the bolt connection to the GC; Take out the ISOBUTYLENE back; connect the tubing from the bag to the GC; Open the valve to 1 full turn; Hit START to run a test; Hit NO when ask to Acknowledge ALARM.
4. After the ISO testing; Hit DISPLAY; Hit the GC mode; Do the same for BTEX like the ISO test but this test is for 500 sec.
5. Before each test; Hit Library then hit CALC then hit YES; this will calibrate to the former cal limits.

6. Hit DISPLAY for VOC mode; Make sure you take out the bag and reconnect the metal connector back to the GC; Hit ENTER to start a test then as the test is running.
7. Hit Enter/Menu button; Select SETUP; Hit MODE; Hit AUTO cycle down to turn it on; hit ENTER then EXIT VOC-GC hit down to turn it on; hit ENTER then EXIT.
8. Lock up the station and move to the next one.
9. The calibration sheets are saved as:
   (site name)_cal_sheets_MMDDYY.

For Lite Stations:

DustTrak Calibration:

1. Press Sampling Mode button until out of logging on screen.
2. When it's not logging, remove the tubing connected to the antennae, insert the zero filter in the inlet.
3. Hold Calibrate button until countdown reaches '0' then release and hit Sample button to allow calibration.
4. The screen will countdown from 60 sec and it will flash '1.00'.
5. Press sample and record reading.
6. Remove filter and replace tubing and hit sampling mode to start logging.
7. Resume monitoring.

PhotoVac 2020 PID:

Note: This piece of equipment uses a 10 parts per million (ppm) calibration gas and no other type is suggested.

1. Press Cal button and remove the tubing connected to the antennae, insert the carbon filter in the inlet.
2. Hit the Right button for Next.
3. After finish zeroing, remove the carbon filter and attached the ISO bag to the inlet.
4. Hit the right button twice to begin calibrations.
5. After it is done, the screen will tell you the status of the lamp and if it needs replacement.
6. The screen will go back to reading and record highest ppm, remove bag, and replace tubing.

7. Resume monitoring, and lock up the station.
8. Record all data onto calibration sheet or field book.

After finishing calibrations, check the station to verify that it has power and the radio transmitter is functioning properly. Verify that all equipment is data-logging. Once this is compete, secure the station and move to the next.

At the site, the air temperature, wind direction, and wind speed will be monitored, if necessary, and recorded using a weather station.

Note, alert and action limits are site specific. Before the start of work, refer to the site work plan and/or project manager for perimeter air monitoring parameters.

4. References

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. May 3, 2010.

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods (Interim Edition), Addendum to Section 2.11 Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere (High-Volume Sampler Method), US Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/038b April 1994.

STANDARD OPERATING PROCEDURE

AR-003 Polyaromatic Hydrocarbons (PAHs) in Ambient Air Method TO-13A

1. Objective

To establish standard procedures for the collection of air samples to be analyzed for polycyclic aromatic hydrocarbon (PAH) concentrations in ambient air.

2. Materials

- Modified High Volume Sampler
- Model PS-1 sample cartridges and filters assembled for PS-1 sampler, or equivalents
- GMW Model GMW-40 calibrator and associated equipment for calibration of the GMW PS-1 sampler
- Ice chest
- Data sheets for recording the location, sample date, duration of sample, starting and stopping times, and calculated sample volume
- Airtight, labeled, screw-capped container (wide mouth, glass with Teflon seal) to hold filter and adsorbent cartridge during transport to analytical laboratory
- Raised platform for the sampling unit
- Powder-free nitrile gloves

3. Execution

This section details the sampling media preparation by the analytical laboratory and is presented for informational purposes.

3.1. Method Summary

- Filters and adsorbent cartridges (containing XAD-2, Polyurethane Foam [PUF], or combination XAD-2 and PUF) are solvent cleaned and vacuum-dried. Cleaned filters and adsorbent cartridges are stored in screw-capped containers wrapped in aluminum foil (for protection from light) prior to installation in a modified high volume sampler. The filters and cartridges are supplied by the laboratory ready for use.
- A calibrated sampler (e.g., General Metal Works Model PS-1 or equivalent is used to draw approximately 325 m^3 of ambient air through the filter and adsorbent cartridge.
- Record location, sampling date, starting and stopping times, temperature, and barometric pressure. Magnahelic gage readings should be recorded hourly and adjusted as needed to maintain air

monitor flow. Calculate the volume of air sampled using the appropriate calibration data for the sampler during that time period.

- The filter and cartridge are placed in an appropriately labeled container and shipped to the analytical laboratory for analysis.
- Heat, ozone, nitrogen dioxide (NO_2), and ultraviolet (UV) light can cause sample degradation. The exposed sampling media must be immediately removed from the sampler, wrapped in clean foil, and packed in ice or refrigerated.

3.2. Sampling Head Configuration

- The sampling head consists of a particulate filter support and a compartment to retain the adsorbent cartridge. Prior to field use, both the filter and adsorbent must be cleaned to <10 micrograms (µg) total PAHs/apparatus.

3.3. Glass Fiber Filter Preparation (performed by laboratory)

- The glass fiber filters are baked at 600°C for five hours before use.
- To ensure acceptability, the filters are extracted with methylene chloride ($MeCl_2$) in a Soxhlet for 16 hours at 4 cycles per hour. The MeCl extract is concentrated and analyzed by Gas Chromatograph or High Pressure Liquid Chromatography. A filter blank of <10 nanogram (ng) PAHs/filter is acceptable.

3.4. XAD-2 Adsorbent Preparation

- Initial cleanup procedure for XAD-2 requires that a batch, approximately 60 grams (g), be extracted via Soxhlet using $MeCl_2$ for 16 hours at 4 cycles/hour.
- XAD-2 resin is removed and dried in a vacuum oven attached to an ultra purge nitrogen (N_2) gas stream and dried at room temperature for 2 to 4 hours.
- A nickel screen (200/200 mesh) is filtered to the bottom of a hexane-rinsed glass cartridge to retain the XAD-2 resin.
- The Soxhlet extracted, vacuum-dried, XAD-2 resin is placed into the sampling cartridge (using polyester gloves) to a depth of approximately 2 inches (approximately 55 g resin).
- The glass module containing the XAD-2 adsorbent is wrapped with hexane-rinsed aluminum foil, placed in a labeled container and tightly sealed with Teflon tape.
- At least one assembled cartridge from each batch must be analyzed, as a laboratory blank, using the procedure in TO-13 Section 13 before the batch is considered acceptable for field use (<10 ng PAHs/cartridge).

3.5. PUF Sampling Cartridge Preparation

- The PUF adsorbent is a polyether-type polyurethane foam (density No. 3014 or 0.0225 g/cm^3) used for furniture upholstery.
- The PUF inserts are 6.0 cm diameter cylindrical plugs cut from 3-inch sheet stock and should fit, with slight compression, in the glass cartridge supported by the wire screen. The plugs are cut using a high speed drill and continuously lubricated with water.
- For initial cleanup, the PUF plug is placed in a Soxhlet apparatus and extracted with acetone for 14 to 24 hours (4 cycles/hr). When cartridges are reused, 5 percent diethylether in n-hexane can be used as a cleanup solvent.
- The extracted PUF is placed in a vacuum oven connected to a water aspirator and dried at room temperature for 2 to 4 hours.

The PUF is placed into the glass sampling cartridge using polyester gloves. The module is wrapped with hexane rinsed aluminum foil, placed in a labeled container, and tightly sealed. At least one assembled cartridge from each batch must be analyzed, as a lab blank, before accepting the batch for use in the field. Blank levels of <10 ng/plug PAH is acceptable.

3.6. Sample Collection

- The essential features of a sampling apparatus are a sampling head, a blower motor, a flow control valve, a voltage variator, and an air flow indicator.
- Each unit is calibrated monthly, at a minimum, and a calibration check is performed daily, before use and at the end of the run, using the calibration kit and calibration curves supplied by the manufacturer.
- The samplers should be located in an unobstructed area, at least 2 meters from any obstacle to air flow. The exhaust hose should be stretched out in the downwind direction to prevent recycling of air into the sample head. The sampler should be placed off the ground on a sturdy stand, with the air inlet 4 to 6 feet off the ground.
- Detach the lower chamber of the rinsed sampling module. While wearing disposable, clean, lint-free nylon or powder-free nitrile gloves, remove a clean glass cartridge/sorbent from its container (wide-mouthed glass jar) and unwrap its aluminum foil covering. Place the foil back into the jar for rewrapping the cartridge after use.
- Insert the cartridge into the lower chamber and tightly reattach it to the module.
- Using clean Teflon tipped forceps, carefully place a clean fiber filter atop the filter holder and secure in place by clamping the filter holder ring over the filter using the three screw clamps. Ensure that all

module connections are tightly assembled. Failure to do so may cause leaks which could affect sample representativeness. Ideally, sample module loading and unloading should be conducted in a controlled environment within a centralized sample processing area so that the sample handling variables can be minimized.

- With the module removed from the sampler and the flow control valve fully open, turn the pump on and allow it to warm up for approximately five minutes.
- Requisite information for the sampling run is recorded on the test data sheet.
- The loaded sample module is attached to the sampler.
- The power switch is turned on. Either direct hookup or generator supplied 110 V AC power is required. The lapsed time meter is activated and the start time is recorded.
- The Magnehelic reading is recorded every hour during the work day. The calibration curve is used to calculate the flow rate. Ambient temperature, barometric pressure, and the Magnehelic reading are recorded at the beginning and end of the sampling period.
- At the end of the sampling period, the power is turned off. Carefully remove the sampling head containing the filter and adsorbent cartridge to a clean area. While wearing disposable lint free nylon or nitrile gloves, remove the sorbent cartridge from the lower module chamber and lay it on the retained aluminum foil in which the sample was originally wrapped. Carefully remove the glass fiber filter from the upper chamber using clean Teflon tipped forceps.
- Fold the filter paper in half twice (sample side inward) and place it in the glass cartridge above the sorbent.
- Wrap the combined samples in aluminum foil and place them in their original glass sample container. A sample label should be completed and affixed to the sample container. Chain of custody records should be maintained for all samples.
- The glass container should be stored in ice and protected from light to prevent photodecomposition of collected analytes. If the time span between sample collection and lab analysis is to exceed 24 hours, samples must be kept refrigerated. Holding time is <20 days.
- A final calculated sample flow check is performed. If flow rate calibration deviated by more than 10 percent from the initial reading, the flow data for that sample must be marked as suspect.
- All samples in the field are stored on ice at 0°C until delivered to the laboratory where they will be stored at 4°C.

4. Notes

- A field blank should be collected which consists of an unexposed filter removed from envelope, put in place in the HV sampler,

immediately removed, folded, replaced in its envelope and sent to the laboratory. Field blanks should be taken at a frequency of one per twenty samples or one per weekly sampling whichever is the greater.

- When handling the sampling cartridge, wear powder free nitrile/surgical gloves for prevention of false data and check the flow rate be checked hourly for potential adjustment throughout the day.

5. References

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods (Interim Edition), Addendum to Section 2.11 Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere (High-Volume Sampler Method), US Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/038b April 1994.

STANDARD OPERATING PROCEDURE

AR-004 Hydrogen Cyanide Work Zone Air Monitoring Procedures

1. Objective

Protect human health through real-time monitoring of hydrogen cyanide gas during field activities.

2. Execution

To monitor cyanide (as hydrogen cyanide gas), the GEI field representative will utilize a real time handheld meter (Multi-Rae with hydrogen cyanide detector, or equivalent) during intrusive activities, or as directed otherwise, including subsurface excavations, borings and monitoring well installation, materials handling, and groundwater sampling in areas with confirmed cyanide impacts.

Due to potential detector interference, hydrogen sulfide gas (H_2S) may also be monitored for comparison to the hydrogen cyanide gas levels detected.

Prior to commencing work onsite, the real-time cyanide meter should be calibrated in accordance with the equipment manufactures specifications. If the meter is calibrated in the field, the daily calibration results will be recorded into the site field notebook. If required, background ambient air monitoring should be completed prior to commencing work activities and recorded into the field notebook. The work zone should be established upwind of the any exposed soils (if possible) to limit potential exposure. Cyanide will be monitored around the perimeter of the work zone on a regular basis. Continuous monitoring will be completed every 15 minutes if sulfur odor or suspected purifier material is encountered. Measurements will be monitored in the breathing zone and will be recorded into the field notebook. In the event that hydrogen cyanide is detected, the GEI field representative will follow the following procedures:

2.1. Response Level: Less than 1 ppm for 15-minute average using real time meter

- Stop work and move (with continuous monitoring meter) at least 25 feet upwind from excavation or until continuous monitoring meter registers <1 ppm.
- Continue monitoring with real time meter.
- Allow area to ventilate and continue to monitor while returning to the work zone.
- Do not move into an area when readings are >1 ppm.
- May resume work when readings are <1 ppm.

3. Notes

No air purifying respiratory protection is available for hydrogen cyanide gas.

The American Conference of Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) for Hydrogen Cyanide is 4.7 ppm.

4. References

Code of Federal Regulations, 40 CFR 50, Appendix J, Reference Method for the Determination of Particulate Matter as PM_{10} in the Atmosphere.

Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Specific Methods (Interim Edition), Addendum to Section 2.11 Reference Method for the Determination of Particulate Matter as PM10 in the Atmosphere (High-Volume Sampler Method), US Environmental Protection Agency, Office of Research and Development, Washington, D.C. EPA/600/R-94/038b April 1994.

STANDARD OPERATING PROCEDURE

AR-005 zNose® Monitoring

1. Objective

The purpose of the zNose® monitoring is to measure naphthalene concentration in real-time and provide early detection in the field of potential short-term emissions.

2. Execution

Odors as a function of naphthalene concentration will be monitored over a 15-minute period and recorded. To measure naphthalene concentrations, the zNose® Model 4200 system or equivalent will be used. The zNose® is an ultra-fast GC that is capable of analyzing airborne concentrations of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) in less than one minute. The zNose® uses a surface acoustic wave (SAW) detector that changes in vibration frequency as compounds elute from the column and condense onto the surface of the detector.

The zNose® is a portable instrument positioned downwind of the remedial activities. A selected number of samples are analyzed for naphthalene concentrations over a 15-minute period. The concentrations will be averaged to produce a 15-minute result. The calibration will be checked at the start of the day, at mid-day, and at the end of the day. An air blank will be run after each of the naphthalene calibrations. A blank will also be run if a reading exceeds the calibration range of the instrument.

The zNose® also has the capability of generating fingerprint images of the chemical constituents in the vapor called VaporPrints™. A VaporPrint™ of an air sample can be compared to others generated at the perimeter and off site to see if remedial operations are the source of the odors. VaporPrints™ can allow for identification of odors that may not be affiliated with remedial operations.

Equipment Calibration

Equipment calibration will be performed according to manufacturer's instructions. The zNose® will be calibrated daily before use. Standards will be tested once during work and once at the end of the day to verify the equipment functional. For the model 4200, helium will be filled prior to the work day. For the model 4300 a backup helium canister will be on hand. A zNose® guide will be provided on site to help with troubleshooting. A particulate monitor and organic vapor analyzer will be in use as well with downwind readings being taken every 15 minutes.

An in-house zNose® expert will review the data for quality assurance prior to final reporting delivery to the client. The zNose® is a screening tool and readings can be confirmed by laboratory analysis or a collocated air sample if needed.

3. Notes

Model 4200

This model must been connected to a 120 volt power source and be refilled with helium throughout the day. The zNose® may not function properly in inclement weather and may give false readings if water enters the intake.

Model 4300

This model is battery powered and lasts several hours. A nearby 120 volt power source is preferred to operate the laptop computer. The unit must be refilled with helium throughout the day. The zNose® may not function properly in inclement weather and may give false readings if water enters the intake.

4. References

zNose® Boot-Camp Handbook, GEI, December, 2006.

Section 11

SOIL GAS SAMPLING (SG)

SUMMARY GUIDANCE

SG-001 General Guidance on Soil Vapor Intrusion Evaluations

1. Objective

Soil vapor intrusion evaluations are used to assess the potential for migration of volatile organic compounds (VOCs) from the subsurface into occupied buildings. This SOP describes issues and factors to consider prior to and during a soil vapor intrusion evaluation. Specific SOPs for the different types of sampling are identified.

2. Background

There are many potential sources (other than MGP residuals) of VOCs in subsurface soil, indoor air, and ambient air. Chlorinated compounds are common sources, and indoor air is often affected by VOCs in cleaning products, solvents, new furniture, rugs, and paints. Any or all of these sources may affect soil vapor, indoor, and ambient air.

Soil vapor intrusion evaluations should be approached on a site-specific basis and depending on the site-specific setting and proximity to impacted groundwater or source material, it may be appropriate to proceed in a hierarchical fashion through each tier of evaluation or a variety of tiers may be combined and implemented simultaneously.

The following events will commonly result in a soil vapor intrusion investigation.

- Identification of a potential complete exposure pathway.
- Private property owner request for sampling.
- State or Federal administrative order.

If little or no data are available then a screening level assessment is an appropriate first step. However, if a significant groundwater plume or source is known to be present near or below, it may be more appropriate to directly develop and implement a soil vapor and/or indoor air sampling plan.

The relevant SOPs to guide the types of sampling that may be necessary are:

- SOP SG-002 Soil Vapor Sample Collection
- SOP SG-003 Sub-Slab Soil Vapor Collection
- Indoor Air Sampling
- SOP SG-004 Ambient Air Sample Collection

3. Factors Affecting Soil Vapor Intrusion

The nature and extent of impacted soil and/or groundwater between the site and the residential/commercial building should be defined. In general, the following characteristics should be understood:

- Surficial geology.
- Depth to groundwater.
- Groundwater flow direction.
- Type and magnitude of soil and groundwater impacts.
- Man-made or natural preferential pathways for vapor migration in the vadose zone.
- Presence of an overlying water bearing zone that does not have impacts beneath the residential or commercial building.
- Potential "smear zones" (residual non-aqueous phase liquid [NAPL] present at depths over which the water table fluctuates).
- Soils which are highly organic, wet, and/or of low permeability.
- Dry and porous soils.
- The limits of backfill surrounding the residential or commercial building.

An un-impacted shallow water zone will significantly retard or completely prohibit the potential for deeper impacted groundwater to affect soil vapor. "Smear zones" may affect the rate of soil vapor migration. Soil texture and moisture content may also affect vapor migration.

If a site characterization or remedial investigation (SC/RI) has already been completed, the relevant data may be available. If the SC/RI has not been completed, some investigation may be necessary.

Building Factors such as structure, floor layout, air flow, and physical conditions can also affect vapor migration and should be documented during the evaluation. The New York State Department of Health (NYSDOH) Center for Environmental Health's Indoor Air Quality Questionnaire and Building Inventory form is presented in Attachment A. At a minimum, the following information should be recorded.

- Building foundation construction characteristics (basement, footers, crawl spaces, etc.), including potential preferential vapor intrusion pathways such as foundations cracks and utility penetrations.
- Basement wall materials (hollow block, stone, or poured concrete, etc.).
- Presence of an attached garage.
- Recent renovations to the building such as new paint or new carpet.

- Mechanical heating/cooling equipment that may affect air flow.
- Use and storage of petroleum products such as home heating oil storage tanks, underground storage tanks (USTs), or kerosene heaters.
- Recent use of petroleum-based finish or other products containing volatile organic compounds (VOCs).
- Areas of pavement on the property should also be identified in the event sub slab vapor sampling is not feasible or appropriate due to a high groundwater table. Paved areas could serve as surrogate locations in lieu of sub slab soil vapor sampling if high water table conditions exist.

The construction materials and integrity of the floor of the structure closest to the potential point of entry for soil vapor (basement level or first floor for slab-on-grade constructions) should be identified, along with potential preferential pathways (utility lines/pipes, sumps, etc.) that may be present within the bottom-most level of the structure.

The operation and presence of heating systems, including fireplaces and clothes dryers, may create a pressure differential between the structure and the outside environment, causing an increase of migration of soil vapor into the building. The NYSDOH guidance document suggests limiting indoor air sampling to the heating season (with the exception of immediate inhalation hazard situations), which is roughly defined as November 15th to March 31st. However, sampling may be completed at any time during the year in response to a request by a community member. In situations where non-heating season sampling has taken place, consideration should be given to re-sampling the property within the heating season. The operation of HVAC systems should be noted on the building inventory form (Attachment A).

During the initial building assessment, and again when sub-slab soil vapor and/or indoor air sampling are performed, differential pressure measurements between indoor air, ambient air, and soil vapor should be collected utilizing a calibrated differential pressure meter and recorded to document the potential effect building conditions have on soil vapor migration.

3.2.3 Chemical Inventory

The chemical inventory complements the identification of the building factors affecting soil vapor intrusion. The chemical inventory will identify the occurrence and use of chemicals and products throughout the building. These products can be used to develop an indoor environmental profile.

A separate inventory should be prepared for each room on the floor being tested as well as any other indoor areas physically connected to the areas

being tested. Inventories will include product names, chemical ingredients, or both. If possible, photographs of the products should be taken of the location and condition of the inventoried products and the photographic records should be indexed with the inventory records.

The products inventory can also be used to document odors and, if possible, portable vapor monitoring equipment measurements should be taken and recorded. A product inventory will be repeated prior to each round of testing at the building. If available, the volatile ingredients should be recorded for each product. If the ingredients are not listed on the label, record the manufacturer's name and address or phone number if available. The product inventory form is presented in Attachment A.

3.2.4 Water Table Conditions and Vapor Intrusion Assessment Approach

If the water table elevation is lower than the basement slab, then the following samples should be collected.

- Sub-slab soil vapor samples.
- Indoor air samples from basement level.
- Indoor air samples from main living space (first floor).
- Outdoor ambient air sample.

See SOPs SG-002 (Soil Vapor Sample Collection), SG-003 (Sub-Slab Soil Vapor Collection), and SG-004 (Ambient Air Sample Collection).

If the water table elevation is higher than the basement slab, then the following tasks should be performed.

- Determine if a sump pump is present and actively pumping water. If sump is actively pumping, collect a sample of groundwater from the sump.
- Collect an indoor air sample from basement level. Collect an indoor air sample from main living space (first floor).
- Identify exterior soil vapor sample location near foundation (outside of foundation backfill) and preferably beneath a surrogate vapor cap (e.g., paved driveway, patio). Collect soil vapor samples from exterior soil vapor location.
- Collect an outdoor ambient air sample.

4. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

5. Attachments

Attachment A – NYSDOH Center for Environmental Health's Indoor Air Quality Questionnaire and Building Inventory Form

Attachment B – Chemical Inventory Template

Attachment A

ATTACHMENT A

Off-Site Property Sampling Documentation Form

Property Location/Address: _____

Property: _____

Sampling Date: _____

Property Location/Address: _____
Property: _____
Sampling Date: _____

Preparer's Name: _____ Date/Time Prepared: _____

Preparer's Affiliation: _____ Phone No.: _____

Purpose of Investigation:_____

1. OCCUPANT Interviewed: Yes □ No □

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

Number of Occupants/persons at this location _____ Age of Occupants_____

2. OWNER OR LANDLORD (Check if same as occupant __) Interviewed: Yes □ No □

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

3. CONTACT NAME (Check if same as Occupant ____, Owner ____)

Last Name: _____ First Name: _____

Address: _____

County: _____

Home Phone: _____ Office Phone: _____

4. PROPERTY LOCATION: _____

Relative to Site:

Direction _____ Direction to Nearest Cross Street: _____

Distance _____ Distance to Nearest Cross Street: _____

Surrounding Land Use:

North: _____ East: _____

South: _____ West: _____

Property Location/Address: _____
Property: _____
Sampling Date: _____

5. PROPERTY BOUNDARIES

Delineate the boundaries of the property (on a separate project map, outline property location, private well location, septic/leachfield location, groundwater flow, compass direction, windrose.)

6. BUILDING CONSTRUCTION

Type of Building (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: _____

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_____

If multiple units, how many? _____

If the property is commercial, type?

Business Type(s) _____

Does it include residences (i.e., multi-use)? Yes □ No □

If yes, how many? _____

Other characteristics:

Number of floors_____ Building age_____

Is the building insulated? Yes □ No □ How air tight? Tight / Average / Not Tight

Construction Material _____

7. BASEMENT AND CONSTRUCTION CHARACTERISTICS

Does the building have a basement and/or crawl space, or is it slab-on-grade construction?

_____

Describe the construction of the basement/crawl space (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other _____

Property Location/Address: _____
Property: _____
Sampling Date: _____

c. Basement floor:	concrete	dirt	stone	other _____
d. Basement floor surface:	uncovered	covered	covered with _____	
e. Concrete floor:	unsealed	sealed	sealed with _____	
	unpainted	painted	painted with _____	
f. Foundation walls:	poured	block	stone	other _____
g. Foundation walls:	unsealed	sealed	sealed with _____	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	

Does your basement have a sump? Yes □ No □

Is, is there water in the sump? Yes □ No □

Describe sump conditions:_____

_____

Have you observed standing water in your basement? Yes □ No □

If so, what is the frequency of this observation? _____During rain events? □

Have you observed sheen atop the standing water? Yes □ No □

Basement/Lowest level depth below grade: _____(feet)

Are there any cracks in the floor of your basement? Yes □ No □

Description: _____

_____

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

Description: _____

_____

What activities occur in the finished basement?

Description: _____

_____

Approximately how many hours per day (or week) do you spend in your basement? _____

8. HEATING, VENTING AND AIR CONDITIONING

Type of heating system(s) used in building: (Circle all that apply – note primary)

Property Location/Address: _____
Property: _____
Sampling Date: _____

Hot Air Circulation	Hot Water Baseboard	Steam Radiation
Electric Baseboard	Heat Pump	Wood Stove
Space Heaters	Radiant Floor	Outdoor wood boiler

Unvented Kerosene Heater Other _____

The primary type of fuel used is:

Fuel Oil	Natural Gas	Electric
Kerosene	Propane	Solar
Wood	Coal	Other? _____

Time of use of each type of heating? _____

Domestic hot water tank fueled by: _____

Boiler/furnace located in: Basement Outdoors Main Floor Other_____

Air conditioning: Central Air Window units Open Windows None

Are there air distribution ducts present? Yes □ No □

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

_____

_____

_____

_____

Type of insulation (e.g. blown, fiber, etc.)? _____

Does building have energy efficient windows (e.g. double paned) Yes □ No □

Was weather-stripping recently added/upgraded? Yes □ No □

Particleboard used in construction? Yes □ No □

9. OCCUPANCY

Property Location/Address: _____
Property: _____
Sampling Date: _____

Level General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, storage)

Basement _____

1st Floor _____

2nd Floor _____

3rd Floor _____

4th Floor _____

10. BULK PETROLEUM STORAGE

Aboveground storage tank on the property Yes ☐ No ☐

If yes, how old is tank? _____ Condition? _____

Last inspected? _____ Location: _____

Describe conduits to building (type, location, and entry portal condition): _____

_____

Underground storage tank on the property. Yes ☐ No ☐

If yes, how old is tank? _____ Condition? _____

Last inspected? _____ Location: _____

Describe conduits to building (type, location, and entry portal condition): _____

_____

11. WATER AND SEWAGE

Water Supply:

Public Water Drilled Well Driven Well Dug Well Other _____

Is there use of groundwater water for irrigation purposes? Yes ☐ No ☐

Sewage Disposal:

Public Sewer Septic Tank Leach Field Dry Well Other _____

12. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Yes ☐ No ☐

If not, is there a separate garage or carport? Yes ☐ No ☐

b. Does the garage have a separate heating unit? Yes ☐ No ☐ NA ☐

Property Location/Address: _____
Property: _____
Sampling Date: _____

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, car)
Yes ☐ No ☐ NA ☐ Please specify_____

Is gasoline stored in the garage? Yes ☐ No ☐

Quantity? _____

d. Has the building ever had a fire? Yes ☐ No ☐

When?_____

e. Is a kerosene or unvented gas space heater present? Yes ☐ No ☐

Where? _____

f. Is there a workshop or hobby/craft area? Yes ☐ No ☐

Where & Type? _____

g. Is there smoking in the building? Yes ☐ No ☐

How frequently? _____

h. Have cleaning products been used recently? Yes ☐ No ☐

When & Type? _____

i. Have cosmetic products been used recently? Yes ☐ No ☐

When & Type? _____

j. Has painting/staining been done in the last 6 months? Yes ☐ No ☐

Where & When? _____

Is house paint stored inside? Yes ☐ No ☐

Where? _____

k. Is there new carpet, drapes or other textiles? Yes ☐ No ☐

Where & When? _____

l. Have air fresheners been used recently? Yes ☐ No ☐

When & Type? _____

m. Is there a kitchen exhaust fan? Yes ☐ No ☐

If yes, where vented?_____

n. Is there a bathroom exhaust fan? Yes ☐ No ☐

If yes, where vented?_____

o. Is there a clothes dryer? Yes ☐ No ☐

If yes, is it vented outside? Yes ☐ No ☐

p. Has there been a pesticide/chemical fertilizer application? Yes ☐ No ☐

Property Location/Address: _____
Property: _____
Sampling Date: _____

When & Type?_____

Conducted by Owner or Private Yard Service _____

Is yard waste/trash burned on-site? Yes □ No □

Do any of the building occupants use solvents at work? Yes □ No □

(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? _____

If yes, are their clothes washed at work? Yes □ No □

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, Use dry-cleaning regularly (weekly) No

Use dry-cleaning infrequently (monthly or less) Unknown

Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Yes □ No □

Date of Installation: _____

Is the system active or passive? Active □ Passive □

Are there any recent/past improvements to building? Yes □ No □

Interior painting? _____

Any landscaping improvements that involved bringing fill on site? Yes □ No □

Other _____

Approximately when (how long ago) did these improvements occur? _____

Does anyone living here engage in any of the following activities or hobbies?

a. Art projects (e.g. oil painting, ceramics, pottery, stained glass, metal sculpture)

Yes □ No □

Name: _____ Age: _____ Sex: _____

Name: _____ Age: _____ Sex: _____

Property Location/Address: _____
Property: _____
Sampling Date: _____

b. Furniture refinishing Yes ☐ No ☐

Name: _____ Age: _____ Sex: _____

Name: _____ Age: _____ Sex: _____

c. Model building(e.g. planes,boats,cars) Yes ☐ No ☐

Name: _____ Age: _____ Sex: _____

Name: _____ Age: _____ Sex: _____

d. Gardening Yes ☐ No ☐

Name: _____ Age: _____ Sex: _____

Name: _____ Age: _____ Sex: _____

e. Automotive work Yes ☐ No ☐

Name: _____ Age: _____ Sex: _____

Name: _____ Age: _____ Sex: _____

f. Ammunition reloading Yes ☐ No ☐

Name: _____ Age: _____ Sex: _____

Name: _____ Age: _____ Sex: _____

Is there a wood burning stove? Yes ☐ No ☐

If so, how frequently is it used?

_____

_____

Is there a barbeque grill? Yes ☐ No ☐

If so, how frequently is it used? What is the type of fuel?

_____

_____

Has the building ever had fumigation? Yes ☐ No ☐

Property Location/Address: _____
Property: _____
Sampling Date: _____

If so, when and how frequently? Type?

_____

_____

13. ODOR SUMMARY

Have the occupants observed any unusual odors? _____

_____

_____

_____

_____

History of odor observation – date of onset, duration, severity, etc.

_____

_____

_____

_____

_____

_____

_____

14. PRODUCT INVENTORY

Record the specific products found in building that have the potential to affect indoor air quality on the attached product inventory form.

15. INDOOR SKETCH

Draw a plan view sketch (on grid paper) of the basement, first floor, and any other floor where sampling was conducted in the building as well as any outdoor sample locations. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Property Location/Address: _____
Property: _____
Sampling Date: _____

Product Inventory
Off-Site Property Sampling Documentation
Soil Vapor Intrusion Investigation

Property Address:	**Performed by:**
Date of Inventory:	**Field Instrument Make & Model:**

Location	Product Description	Size (units)	Condition *	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y/N

Notes

* Describe the condition of the product containers as Unopened (UO), Used (U), or Deteriorated (D)

** Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Attachment B

Product Inventory
Off-Site Property Indoor Air Sampling Documentation

Property Address:	**Performed by:**
Date of Inventory:	**Field Instrument Make & Model:**

Location	Product Description	Size (units)	Condition *	Chemical Ingredients	Field Instrument Reading (PPM)	Photo** Y/N
Kitchen						
Bathroom						
Basement						

Notes:
1 = Various Locations. Products were placed in plastic bins and removed from the residence 24 hours prior to the sampling.
* Condition of the product containers: Unopened (UO) , Used (U), or Deteriorated
** Photographs of the front and back of product containers to document chemical ingredients. (Y = Yes; N = No)
PPM = parts per million
NL = Not Listed

STANDARD OPERATING PROCEDURE

SG-002 Soil Vapor Sample Collection

1. Objective

This procedure outlines the general steps to collect soil vapor samples. The site-specific project work plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary soil vapor probes should be installed using the procedures outlined below. All soil vapor probes should be installed using a direct-push drill rig (e.g., GeoProbe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

- Document pertinent field conditions prior to installation of any probe points.
- Record weather information (precipitation, 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 onsite equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Soil Vapor Point Installation Specifications

Each soil vapor point should be constructed as follows:

- Six-inch stainless steel Geoprobe® AT86 series Permanent Implants (soil vapor screens) or equivalent and threaded to an (expendable) stainless steel anchor point.
- The implants should be fitted with inert Teflon or stainless steel tubing of laboratory or food grade quality.
- The annular space surrounding the vapor screen interval and a minimum of 6-inches above the top of the screen should be filled with a

porous backfill material (e.g., glass beads or coarse silica sand) to create a sampling zone 1 foot in length.

For temporary points, a hydrated bentonite surface seal should be created at the surface to minimize infiltration. For permanent points, the additional measures described below should be included.

- The soil vapor points should be sealed above the sampling zone with a bentonite slurry for a minimum distance of 3 feet (or to grade, whichever is smaller) to prevent ambient air infiltration.
- If needed, the remainder of the borehole should be backfilled with clean material.
- A protective casing should be set around the top of the point tubing and grouted in place to the top of the bentonite to minimize infiltration of water or ambient air, as well as to prevent accidental damage to the soil vapor point.
- The tubing top should be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

2.3. Soil Vapor Sample Collection

Soil vapor samples should be collected as indicated in the work plan and in accordance with applicable state or federal guidance documents. Specifically, samples from the points should be collected as follows:

- Permanent soil vapor points should not be sampled or purged for a minimum of 24 hours after installation. Temporary points may be purged and sampled immediately following installation.
- Document pertinent field conditions prior to sampling as described above.
- A suction pump should be used to remove a minimum of three implant volumes from the soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and the annular space between the probe and the native material if sand or glass beads were used.
- The purge rate shall not exceed 0.2 liters per minute (lpm).
- Samples should be collected for volatile organic compounds (VOCs) in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate should not exceed 0.2 lpm.
- A helium tracer gas should be used to identify any potential migration or short circuiting of ambient air during sampling as described below in section 2.4.
- 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.
- 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 should 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.
- Samples should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Include the required copies of the chain of custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain of custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- A portion of the laboratory analytical data should 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 Standard Operating Procedure (SOP) for the Validation of Organic Data modified to

accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945. The percentage of data required for validation is site-specific, dependent on approvals from the NYSDEC.

2.4. 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 each temporary soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent soil vapor probe during the initial sampling event and a minimum of 10% of the soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

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 utilizing a VOC-free clay, bentonite, beeswax, or another suitable method.
- Introduce the tracer gas into the chamber. The chamber should 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. Close the valve after the chamber has been enriched with tracer gas at concentrations >50% as indicated by a calibrated helium detector.
- The chamber should 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 should 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 collecting an analytical sample or using a portable device to measuring the tracer gas concentration.
- Samples collected from vapor points during a tracer gas evaluation should be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the

bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.

- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary.

If the evaluation on a probe 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 subsequent sample collection.

A non-detectable level of tracer gas is preferred, however, if the evaluation on a probe 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.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

STANDARD OPERATING PROCEDURE

SG-003 Sub-slab Soil Vapor Collection

1. Objective

This procedure outlines the general steps to collect sub-slab soil vapor samples. The site-specific project work plan should be consulted for proposed sample locations, sample depths, and sampling duration.

2. Execution

Permanent and temporary sub-slab soil vapor probes will be installed using the procedures outlined below. All sub-slab soil vapor probes will be installed using a direct-push drill rig (e.g., GeoProbe® or similar), hand auger, or manually using a slide hammer.

2.1. Document Field Conditions

Document pertinent field conditions prior to installation of any probe locations.

- Record weather information (precipitation, 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 onsite equipment or obtained from a reliable source of local measurements (e.g., a local airport). Data should be obtained for the past 24 to 48 hours. Record the indoor conditions (temperature, heating/cooling system active, windows open/closed, etc.).
- Measure the differential pressure at the building. Measure the indoor and outdoor barometric pressure using a high resolution device. Where possible, measure the sub-slab barometric pressure at the sampling point.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Indoor floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, heating, ventilating and air conditioning (HVAC) system air supply and return registers, compass orientation (North), footings that create separate foundation sections, and any other pertinent information should be completed.
- Outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas.

- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sub-Slab Soil Vapor Point Installation Specifications

Each sub-slab soil vapor point will be constructed as follows:

- Drill an approximately 3/8-inch hole through the slab. If necessary, advance the drill bit 2-3 inches into the sub-slab material to create an open cavity.
- Using dedicated inert Teflon or stainless steel tubing of laboratory or food grade quality, insert the inlet of the tubing to the specified depth below the slab. For permanent installation, only stainless steel tubing and fittings will be used.
- For permanent point installations, the annular space surrounding the vapor probe tip will be filled with a porous backfill material (e.g., glass beads or coarse silica sand) to cover 1-inch of the above the tip of the probe.
- Seal the annular space between the hole and the tubing using an inert non-shrinking sealant such as melted 100% beeswax, permagum grout, putty, etc. For permanent installations, cement may be used.
- For permanent points, a protective casing will be set around the top of the point tubing and grouted in place minimize infiltration of water or ambient air, as well as to prevent accidental damage to the permanent point.
- The tubing top will be fitted with a Swagelok® and cap to prevent moisture and foreign material from infiltrating the tubing.

In cases where sub-slab sampling is impractical or infeasible, a surrogate location (attached garage, concrete patio, asphalt driveway, etc.) may be used if it is representative of sub-slab conditions. In surrogate locations, the vapor sampling point may be installed in accordance with SOP SG-002, *Soil Vapor Collection*.

2.3. Sub-Slab Soil Vapor Sample Collection

Sub-slab soil vapor samples will be collected as indicated in the site-specific project work plan and in accordance with state or federal guidance documents. Specifically, sub-slab samples from the points will be collected as follows:

- Document pertinent field conditions prior to sampling as described above.
- A suction pump will be used to remove one to three implant volumes from the sub-slab soil vapor points prior to sampling. Include the volume of any additional tubing added to affix sampling equipment and

the annular space between the probe and the native material if sand or glass beads were used.

- The purge rate shall not exceed 0.2 liters per minute (lpm).
- Samples will be collected in an individually laboratory certified clean 1-liter SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (4 minutes). The regulator flow rate will not exceed 0.2 lpm.
- A helium tracer gas will be used to identify any potential migration or short circuiting of ambient air during sampling as described below in Section 2.4.
- 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 sub-slab soil vapor probe to the flow controller.
- 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.

- Samples will be analyzed for volatile organic compounds (VOCs) and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Include the required copies of the chain of custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain-of-custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.
- 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 Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15 and natural gas analysis by ASTM D-1945.

2.4. Tracer Gas Evaluation

The tracer gas evaluation provides a means to evaluate the integrity of the sub-slab soil vapor probe seal and assess the potential for introduction of indoor air into the sub-slab soil vapor sample. A tracer gas evaluation should be conducted on the each temporary sub-slab soil vapor probe to be sampled in a sampling event. A tracer gas evaluation should be conducted on the each permanent sub-slab soil vapor probe during the initial sampling event and a minimum of 10% of the sub-slab soil vapor probes during subsequent sampling events.

The following tracer gas evaluation procedure uses helium as a tracer gases which can be measured through laboratory analysis or by a portable detector.

- Retain the tracer gas around the sub-slab 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. 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 sub-slab 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 sub-slab

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 purge one to three tubing volumes prior collecting an analytical sample or using a portable device to measuring the tracer gas concentration.

- Samples collected from vapor points during a tracer gas evaluation will be analyzed for VOCs and naphthalene via modified USEPA modified Method TO-15 and helium via ASTM D-1945.
- Alternately, a tracer gas detector may be used to verify the presence of the tracer gas in the chamber by affixing it to the valve fitting at the bottom of the chamber. The tracer gas detector may also be used to measure the tracer gas concentration in the pump exhaust during purging. If used, then record the tracer gas concentrations in the chamber and in the soil vapor sample.
- Based on the concentrations of the tracer gas detected during analysis or direct measurement, determine whether additional gas tracer evaluations are necessary.

If the evaluation on a probe 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 subsequent sample collection.

A non-detectable level of tracer gas is preferred; however, if the evaluation on a probe 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.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006.

STANDARD OPERATING PROCEDURE

SG-004 Ambient Air Sample Collection

1. Objective

This set of procedures outlines the general steps to collect ambient air samples. The site-specific project work plan should be consulted for proposed sample locations and sampling duration.

2. Execution

The following procedures will be followed for the collection of ambient air samples:

2.1. Document Field Conditions

Document pertinent field conditions prior to sample collection.

- Record weather information (precipitation, 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). Data should be obtained for the past 24 to 48 hours.
- If sampling near a commercial or industrial building, uses of volatile chemicals during normal operations of the facility should be identified.
- Outdoor plot sketches should be drawn that include the site, area streets, neighboring commercial or industrial facilities (with estimated distance to the site), outdoor air sampling locations (if applicable), and compass orientation (North).
- Any pertinent observations should be recorded, such as odors and readings from field instrumentation.

2.2. Sample Collection

- Select a location upwind of the building or other area that is being evaluated.
- Samples will be collected in an individually laboratory certified clean SUMMA® canister (or equivalent) using a certified flow controller calibrated for the anticipated sample duration (1-hour, 8-hour, etc.). The regulator flow rate will not exceed 0.2 liters per minute (lpm).
- 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.
- 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. 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.
- Samples will be analyzed for volatile organic compounds (VOCs) and naphthalene via modified USEPA modified Method TO-15.
- Include the required copies of the chain of custody form in the shipping packaging, as directed by the laboratory. Maintain a copy of the chain of custody for the project file.
- Deliver or ship the samples to the laboratory as soon as practical.

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 Standard Operating Procedure (SOP) for the Validation of Organic Data modified to accommodate the USEPA Method TO-15.

3. References

USEPA modified Method TO-15 and helium via ASTM D-1945.

Section 2.7.1 of the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York*, dated October 2006.*

Section 12

QUALITY CONTROL – QUALITY ASSURANCE (QA)

STANDARD OPERATING PROCEDURE

QA-001 Equipment Decontamination

1. Objective

This Standard Operating Procedure (SOP) describes methods used for preventing or reducing cross-contamination, and provides general guidelines for sampling equipment decontamination procedures. Preventing or minimizing cross contamination in sampled media and in samples is important for preventing the introduction of error into sampling results and for protecting the health and safety of site personnel. Removing or neutralizing contaminants that have accumulated on sampling equipment ensures protection of personnel from permeating substances, reduces or eliminates transfer of contaminants to clean areas, prevents the mixing of incompatible substances, and minimizes the likelihood of sample cross-contamination.

In all cases, requirements specified in the project-specific Quality Assurance Project Plan (QAPP) and/or any other site-specific plan will prevail over this document.

2. Execution

All non-dedicated sampling equipment shall be cleaned between each use in the following manner:

1. Wash/scrub with a biodegradable degreaser (“Simple Green”) if there is oily residue on equipment surface;
2. Tap water rinse;
3. Wash and scrub with Alconox (or non-phosphate soap) and water mixture;
4. Tap water rinse;
5. All equipment used to collect samples for volatile organic compound (VOC) and semi-volatile organic compound (SVOC) analysis will then receive a laboratory grade, 100% methanol rinse followed by a de-ionized water rinse;
6. 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;
7. The drilling equipment will be decontaminated in general accordance with methods described in the appropriate sections of this document; and
8. 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.

All drilling equipment shall be cleaned in the following manner:

1. Inspect equipment for cleanliness prior to moving onto a site and prior to relocating to each new sampling location. All contractor-provided equipment (augers, rods, spoons, backhoe buckets) shall be decontaminated by steam cleaning **prior to coming on site.**
2. Equipment decontamination consists of an Alconox-solution wash (or equivalent non-phosphate detergent) and/or potable water rinse or steam cleaning.
3. Alconox solution is a mixture of approximately 1 cup of Alconox per 1 gallon of potable water. Alconox solution wash requires scrubbing the equipment with a brush soaked in Alconox solution and removing any visible contamination or dirt from the equipment.
4. Before advancing each boring and in between samples, drilling equipment (including augers, casing, rods, and washtub) must be decontaminated.
5. The split-spoon decontamination procedure includes: a gross wash and scrub in a bucket of Alconox solution and potable water rinse.

3. Notes

- Do not store the deionized/distilled water in polyethylene bottles, use Nalgene, glass, or Teflon. Polyethylene may leach phthalates.
- Do not attempt to decontaminate string or rope – replace it.
- Due to eye and skin absorption hazards, safety glasses and gloves must be worn when handling decontamination solvents.
- The decontamination procedure may require modification based on site-specific conditions and methods used should not interfere with the site-specific chemical analyses. The procedure may also require modification based on state regulations.
- Steam cleaning with potable water is an acceptable decontamination method for drilling equipment (i.e., augers).
- Dedicated equipment does not need to be decontaminated beyond initial decontamination prior to field use, if warranted.

4. References

Environmental Response Team (ERT), US EPA. Sampling Equipment Decontamination, SOP No. 2006, Revision 0.0. August 11, 1994.

US EPA Region 9. Sampling Equipment Decontamination, SOP No. 1230, Revision 1. September 1999.

STANDARD OPERATING PROCEDURE

QA-002 Field and Laboratory Quality Control Procedures

1. Objective

Field Quality Control (QC) samples are used to monitor the reproducibility and representativeness of the field activities. The QC samples are handled, transported, and analyzed in the same manner as the associated field samples. QC samples may include trip blanks, field blanks, and field duplicates. QC sample rationale, procedure and frequency are presented below and further defined within the project-specific work plan (WP) and/or Quality Assurance Project Plan (QAPP).

In all cases, requirements specified in the project-specific QAPP and/or any other site-specific plan will prevail over this document.

2. Execution

2.1. Trip Blanks

- Used to monitor possible sources of contamination from transport, storage, inadequate bottle cleaning, or laboratory methodologies.
- Sample containers filled at the laboratory with analyte-free water, are transported to and from the site, and are not opened until time of analysis.
- Trip blanks are stored with the sample containers prior to and after field activities and remain with the collected samples until analyzed.
- Generally, one trip blank per volatile organic compound (VOC) shipment.

2.2. Equipment Blanks

- Equipment blanks, are used to monitor the adequacy of decontamination procedures and possible sources of contamination from inadequate bottle cleaning or laboratory methodologies.
- Equipment blanks are samples collected by pouring laboratory supplied or distilled or deionized water through a decontaminated or dedicated piece of field equipment.
- Prepare field-cleaned equipment blanks immediately after the equipment is cleaned in the field and before leaving the sampling site.
- Collect these blanks using sampling equipment that has been cleaned in the field (i.e., between sampling points). The cleaning procedures used for the blank collection must be identical to those used for the field sample collection.

- The water is then collected in a sample bottle(s) and stored with the associated field samples and submitted for analysis.
- Generally collected at a frequency of 1/20 samples and when non-dedicated sampling equipment is used. Check project-specific WP and/or QAPP for required frequency.

2.3. Field Duplicates

- Used to evaluate the precision and representativeness of the sampling procedures.
- Field duplicates are two samples collected from the same location using the same procedures. Both samples are submitted to the laboratory as individual samples with different sample identification.
- Field duplicates from groundwater sampling are collected by alternating filling sample containers from the same sampling device. Volatile samples must be collected from the same dedicated equipment.
- Soil or sediment field duplicates are collected by homogenizing the sample for all analyses except volatiles. The homogenized sample is then divided into two equal portions and placed in separate sample containers. Field duplicates for volatile analysis are collected at two adjacent sampling locations.
- Each sample is assigned different sample identifications.
- Generally collected at frequency of 1/20 samples. Check project-specific WP and/or QAPP for required frequency.
- All field QC samples should be labeled in the field and submitted “blind” to the laboratory.

2.4. Matrix-Spike samples (MS/MSD)

- Matrix spike and matrix spike duplicate samples (MS/MSDs) are environmental samples that are spiked in the laboratory or in the field with a known concentration of a target analyte(s) to verify percent recoveries.
- MS/MSD samples are primarily used to check sample matrix interferences. They can also be used to monitor laboratory performance. However, a data set of at least three or more results is necessary to statistically distinguish between laboratory performance and matrix interference.
- The minimum frequency of MS/MSDs should be five percent of the total number of samples being analyzed for the target analyte(s).
- MS/MSD samples are also used to evaluate error due to laboratory bias and precision.

- One MS/MSD pair per target analyte should be analyzed and the average percent recovery should be calculated to assess bias.
- To assess precision, at least eight matrix spike replicates from the same sample should be analyzed and the standard deviation and coefficient of variation should be determined.

2.5. Typical QA/QC Frequency

- All QA/QC frequency is project-specific and should be verified prior to sample collection by checking the project-specific WP and/or QAPP.

Duplicate Samples	Shall be collected at a frequency of one replicate soil sample per every twenty primary soil samples collected.
Equipment Blanks	Shall be collected at a rate of one per every type of non-dedicated sampling equipment.
Trip Blanks	Shall be collected every day soil samples are collected for volatile analyses.
Field Blanks	Shall be collected every day soil samples are collected for volatile analyses.
MS/MSDs	The laboratory shall be provided sufficient sample volume for select samples so that it can perform project-specific MS/MSD analyses at a rate of one per every 20 samples (project specific MS/MSD analysis is not required for projects in which less than 20 samples are collected).

3. Limitations

- Trip blanks must never be opened in the field.
- Trip blanks are usually for VOCs only because less volatile compounds are not likely to cross-contaminate other samples by simply being in close proximity.
- Water of documented quality must be used during the collection of field blanks.
- Field duplicates must have different sample identifications.

4. References

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (November 1986), U.S. Environmental Protection Agency Department of Solid Waste, Washington, D.C.

U.S. Environmental Protection Agency Office of Emergency and Remedial Response, 1990, Quality assurance/quality control guidance for removal activities: EPA/540/G-90/004, Sampling QA/QC Plan and Data Validation Procedures Interim Final, April, 1990.

DER-10, Technical Guidance for Site Investigation and Remediation. New York State Department of Environmental Conservation. *May 3, 2010.*

Analytical Service Protocol, New York State Department of Environmental Conservation. *July 2005.*

US EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations (EPA QA/R-5, March 2001).

Guidance for Quality Assurance Project Plans (EPA QA/G-5, December 2002).

5. Attachments

Attachment A – General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

Attachment A

Table 2. General Guidelines for selecting equipment on the basis of construction material and target analyte(s)

[✔, generally appropriate for use shown; Si, silica; Cr, chromium; Ni, nickel; Fe, iron; Mn, manganese; Mo, molybdenum; CFC, chlorofluorocarbon; B, boron]

Construction material for sampling equipment		Target analyte(s)	
Material	**Description**	**Inorganic**	**Organic**
		Plastics[1]	
Fluorocarbon ploymers[2] (other varies available for differing applications)	Chemically inert for most analytes	✔ (potential source of fluoride)	✔ (Sorption of some organics)
Polypropylene	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polypropylene (linear)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Polyvinyl chloride (PVC)	Relatively inert for inorganic analytes	✔ (not appropriate for Hg)	**Do not use**
Silicone	Very porous. Relatively inert for most inorganic analytes	✔ (potential source of Si)	**Do not use**
		Metals	
Stainless steel 316 (SS 316)	SS-316-metal having the greatest corrosion resistance. Comes in various grades. Used for submersible pump casing.	✔ (Potential source of Cr, Ni, Fe, and possible Mn and Mo) **Do not use** for surface water unless encasted in plastic.	✔ Do not use if corroded[3]
Stainless steel 304	Similar to SS-316, but less corrosion resistant	**Do not use**	✔ Do not use if corroded[3]
Other metals: brass, iron, copper, aluminum, galvanized and carbon steels	Refrigeration-grade copper or aluminum tubing are used routinely for collection of CFC samples	**Do not use**	✔ Routinely used for CFCs Do not use if corroded[3]
		Glass	
Glass, borosilicate (laboratory grade)	Relatively inert. Potential sorption of analytes	✔ **Do not use** for trace element analyses. Potential source of B and Si	✔

[1]Plastic used in connection with inorganic trace-element sampling should be uncolored or white. Tubing used for trace metal sampling should be cleaned by soaking in 5-10 percent HCl solution for 8-24 hours, rinsing with reagent water (metals free) and allowed to air dry in mercury-free environment. After drying, the tubing is doubled-bagged in clear polyethylene bags, serialized with a unique number, and stored until used.

[2] Fluorocarbon polymers include materials such as Teflon™, Kynar™, and Tefzel™ that are relatively inert for sampling inorganic or organic analytes. Only fluoropolymer should be used for samples that will analyzed for mercury because mercury vapors can diffuse in or out of other materials, resulting in either contaminated or biased results.

[3] Corroded/weathered surfaces are active sorption sites for organic compounds.

APPENDIX I – HEALTH AND SAFETY PLAN

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Health and Safety Plan

Rockaway Park Site

Borough of Queens
Far Rockaway, NY

NYSDEC Consent Index No. D1-0002-98-11
Site #2-41-029

GEI Consultants, Inc.
110 Walt Whitman Road, Suite 204
Huntington Station, NY 11743
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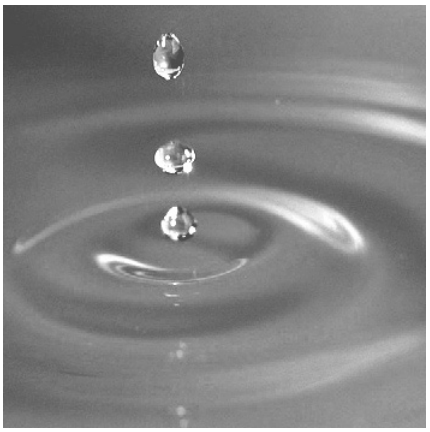
July 2012
093150



Matt O'Neil
Project Manager

Reviewed by:
Steven Hawkins, ASP
Regional Health & Safety Officer

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Appendices

Appendix A Site-Specific Information
Appendix B Cold Stress Guidelines
Appendix C Heat Stress Guidelines
Appendix D Utility Clearance Forms and Procedures
Appendix E Incident Reporting
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Appendix I LIPA Policies

RECORD OF CHANGE		
Revision	**Date**	**Description**
0	**July 2002**	**Initial Draft**
1	**July 2012**	**Updated for site activities**

Health and Safety Plan

1. Background Information

1.1 General

Engineer GEI Consultants, Inc. (GEI)
110 Walt Whitman Road, Suite 204
Huntington Station, NY 11746

Project Name Rockaway Park Former MGP Site
Far Rockaway, NY

This Health and Safety Plan (HASP) establishes policies and procedures to protect GEI personnel from the potential hazards posed by the activities at the Rockaway Park Former MGP Site located in the Town of Far Rockaway, Queens County, New York (see **Appendix A** – Site-Specific Information). The site is currently owned by National Grid.

Reading of and adherence to the HASP is required of all onsite GEI personnel. 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. GEI will verify that its subcontractor's HASP includes National Grid's 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, emergencies, or during adverse weather conditions. Activities performed under this HASP will comply with applicable parts of OSHA Regulations, primarily 29 Code of Federal Regulations (CFR) Parts 1910 and 1926, and National Grid policies and procedures.

1.2 Project Description

Activities conducted at the Rockaway Park Former MGP Site may consist of:

Sitewide tasks include:

- Soil Borings
- Soil and Groundwater Sampling
- Gauging and Recovery of Dense Non-Aqueous Phase Liquid (DNAPL)
- Well Installation

1.3 Site Description

The former MGP, known as Rockaway Park, was once owned by the Long Island Lighting Company (LILCO), a predecessor of National Grid, prior to being demolished in 1958. The site is currently bordered by Beach Channel Drive and Jamaica Bay to the north, Rockaway Freeway to the south and west, and Beach 108th Street to the east. Additionally, the Rockaway Beach substation is located near the northwestern corner of the site.

The geographic boundaries of each operable unit are shown on figures provided in **Appendix A**. Work covered by this HASP may be performed within or near any of these operable units.

1.4 Hazard/Risk Analysis

1.4.1 Physical Hazards

Physical hazards associated with heavy equipment operations may be present should the need arise to excavate, trench, or install or abandon groundwater monitoring wells or other sample points. These activities would require the use of heavy equipment by subcontractors such as a backhoe or a drill rig, which is associated with, but not limited to, the following hazards:

- bodily injuries
- slipping, tripping or falling
- heavy lifting

1.4.2 Fire and Explosion

Fire extinguishers are located on heavy equipment operating onsite and within any work vehicles onsite. All fires should be reported to 911 emergency services. National Grid and the GEI project manager will determine if it is necessary to shut down site work for the day due to fire related issues.

1.4.3 Cold Stress

During the winter months, workers 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 the avoidance of cold stress are provided in **Appendix B** – Cold Stress Guidelines.

1.4.4 Heat Stress

A heat stress prevention program will be implemented when ambient temperatures exceed 70ºF. The procedures to be followed are provided in **Appendix C** – Heat Stress Guidelines.

1.4.5 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps and generators. Site workers who will perform suspected or established high noise tasks and operations for short durations (less than 1-hour) shall wear hearing protection. If deemed necessary by the Site Safety Officer (SSO), the Corporate Health & Safety Officer (CHSO) will be consulted on the need for additional hearing protection and the need to monitor sound levels for site activities. Other workers who do not need to be in proximity of the noise should distance themselves from the equipment generating the noise.

1.4.6 Hand and Power Tools

In order to complete the various tasks for the project, personnel will use hand and power tools. The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. Work gloves, safety glasses, and hard hats will be worn by the operating personnel at all times when using hand and power tools and Ground Fault Indicator (GFI)-equipped circuits will be used for all power tools.

1.4.7 Slips, Trips, and Falls

Working in and around the site will pose slip, trip and fall hazards due to slippery surfaces. Excavation at the sites will cause uneven footing in the trenches and around the spoil piles. GEI employees will wear proper footwear (i.e. steel toe boots) and will employ good work practice and housekeeping procedures to minimize the potential for slips, trips, and falls.

1.4.8 Manual Lifting

Manual lifting of objects and equipment may be required. Failure to follow proper lifting technique can result in back injuries and strains. Site workers should use power equipment (such as a forklift) 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
6) turn with your feet, don't twist

1.4.9 Projectile Objects and Overhead Dangers

Overhead dangers, including but not limited to falling debris and equipment, can occur while heavy machinery is in operation. GEI staff will be instructed to maintain a minimum distance from large overhead operations. Staff must also maintain proper communication

with heavy equipment operators and their handlers, especially if work necessitates their presence beyond the minimum safe distance. Additionally, employees should be cognizant of low-hanging overhead power lines, as these can snag on vehicles entering and exiting the site. Vehicles that are large enough to damage overhead power lines require spotters when entering and exiting the site. Proper PPE will be worn at all times during these types of activities including steel-toed or equivalent boots, safety vests and hard hats.

1.4.10 Heavy Equipment Operation

Heavy equipment will not be operated by GEI personnel, but may be present onsite due to continuing projects. GEI personnel should be cautious when working near operating heavy equipment, and maintain a safe distance from the equipment. Personnel should maintain eye contact with the vehicle spotter or operator before traversing any paths that may cross that of the machinery.

1.4.11 Excavation and Trenching

GEI personnel will not enter a trench or excavation that is greater than 4 feet deep.

The safety requirements for each excavation 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 employees. The competent person must also have the authorization to take prompt corrective measures to eliminate unsatisfactory conditions.

The following are general requirements for work activities in and around excavations:

- Prior to initiation of any excavation activity (or ground intrusive activity, such as drilling), the location of underground installations will be determined. The New York State one-call 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 shall be determined by means that are safe to workers, i.e., hand dig, test pits, etc.
- All excavations will be inspected daily by the 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 shall be placed at least 5 feet from the edge of the excavation.
- Vehicular traffic and heavy equipment shall remain at least 5 feet from the face of the excavation.
- All excavation operations will cease immediately during hazardous weather conditions such as high winds, heavy rain, lightning and heavy snow.

Excavation Entry Safety

- The sides of all excavations in which personnel will be exposed to the danger of moving ground or potential cave-in will be adequately sloped, shored or contained within a trench box, or similar support structure designed and sealed by a professional engineer.
- The air in the excavation will be tested for oxygen deficiency, explosivity, organic vapors, carbon monoxide and hydrogen sulfide. The bottom, middle, top and corners of the excavation will be tested prior to entry and continuously during excavation entry.
- Ramps or ladders will be used to provide access and sufficient egress to the excavation. Ladders must be supplied for every 25 feet of lateral travel. Ladders must be securely anchored at the top or bottom and must extend at least 3 feet above the ground surface. A competent person is required to design ramps (those used exclusively for employee access/egress). Such ramps are constructed of wood, steel or earth. Structural ramps, used for vehicle/equipment access (steel or wood) must be designed by a competent person qualified in structural design. Vehicle ramps built of earth are not considered "structural ramps".
- Employees shall not work in excavations where there is an accumulation of water or in excavations where water is accumulating unless adequate precautions have been taken to protect employees against the hazards posed by water accumulation.
- Where hazardous atmospheric conditions exist or may reasonably be expected to develop during work in an excavation, Permit Required Confined Space entry procedures (**Appendix I**) will be followed if entry into the excavation is required.

1.4.12 Working Within a Temporary Enclosure

Any work conducted within a temporary enclosure shall employ work zone and ambient monitoring in accordance with the Air Monitoring Plan and Section 8.0 of this HASP. If internal combustion engine equipment is used within the temporary enclosure, engineering controls, additional air monitoring parameters, and additional worker protection measures will need to be evaluated. If monitoring indicates the enclosure atmosphere meets the definition of a Permit Required Confined Space (PRCS), then the procedures of **Appendix I** will apply in accordance with OSHA 1910.146 and 1910.134.

1.4.13 Line Breaking Activities

During line breaking activities, the potential exists for exposure to suspect asbestos containing materials (ACM). If suspect ACM is encountered, work will stop and will not resume until asbestos trained personnel have been upgraded to the proper PPE, and water is available to keep the work area and the suspect ACM wetted. All workers are to have completed asbestos awareness training prior to working with suspect ACM. The project management team (National Grid Project Manager, Consultant Project Manager, Contractor Project Manager, and CHSO) is to be notified if suspect ACM is encountered.

1.4.14 Additional Physical Hazards

GEI personnel should verify that all electric, gas, water, steam, sewer, and other utility service lines are located and marked before any intrusive work is started. In each case, any utility company that is involved should be notified in advance by the Contractor according to markout procedures, and its approval or services, if necessary, shall be obtained.

1.4.15 Electrical Hazards

The most serious physical hazard on site is the electrical hazards present in the LIPA electrical substation. The substation proper is enclosed by a perimeter fence and a locked gate. When GEI employees need access to the work area within the substation they will be escorted by a LIPA representative. Electrical transmission and distribution lines at the substation carry between 13 and 33 kilovolts of electricity.

Electrical hazards are typically the most serious physical hazards associated with working on or near an electric substation. All activities at the Rockaway Park Former MGP Site are conducted inside of the substation perimeter and measures to mitigate exposure to overhead and subsurface electrical transmission and distribution lines should be adhered to at all times due to the overhead and underground utilities. These measures include:

General Requirements

- A LIPA representative or designate must perform oversight during activities within the substation.
- Conduct work under the supervision of a LIPA Health and Safety representative as required.
- When working within the perimeter of the substation, or while conducting intrusive work inside or outside the substation, Electrical Hazard (EH)-rated footwear, a hardhat, rubber gloves, and arc flash rated clothing that meet NFPA 70E standards is to be worn. See Section 12 for information regarding PPE.
- Rubber gloves and arc flash rated clothing are required if hand digging in a substation in/or around energized conductors.
- Use insulated lineman's gloves (NFPA 70E) when handling equipment that may come into contact with underground utilities.
- Avoid working within the perimeter of the LIPA substation in conditions of high humidity or rain or thunderstorms.
- Stop work immediately and vacate the work area in the event lightning is observed.
- Avoid carrying tools/equipment above waist height if overhead electric hazards exist.

Utility Protection Requirements

- Existing underground transmission/distribution lines and utilities must be marked out by LIPA survey/mark out personnel prior to any intrusive work. Markouts must be checked every 10 days and updated as necessary.
- LIPA will also markout the safe off-set distance, as determined by LIPA, for electrical facilities, substation equipment and utility poles prior to intrusive work.
- If necessary, additional markouts may be performed by a private utility locating service.
- Contact DigNet of New York City and Long Island at (811) at least 72 hours prior to any invasive activities for mark out of underground public utilities.
- Complete utility clearance documentation included in **Appendix D**.
- Obtain the most recent as-built drawings of the transmission/distribution line layout from National Grid.
- The qualified environmental professional on site must receive and maintain copies of all one call numbers, tickets, utilities plates, private utility location information and test pit logs.
- All monitoring well or soil boring locations will be hand cleared to a minimum depth of 5 feet below ground surface. Additional hand clearing deeper than 5 feet will be determined by LIPA.
- All hand clearing will be performed using fiberglass non-conductive tools or vacuum extraction methods and/or air knife.

Vehicle and Equipment Grounding Requirements

- All equipment involved in intrusive activities in a substation in/or around energized conductors will be grounded using a LIPA-approved grounding wire as directed by LIPA, which must be a minimum of 100 ft. long and have an ampacity equal to or greater than 4 AWG copper wire, and be constructed in accordance with LIPA specifications **(Appendix I)**.
- The grounding wire will be connected to a known grounding point at the substation, or to a temporary ground rod if a known grounding point is located too far from the work area.
- All equipment requiring grounding will be equipped with a LIPA-approved ground connection welded to the vehicle frame in a paint-free area of metal-to-metal contact only.
- All heavy equipment operating in conditions where the overhead or underground electrical voltage exceeds 33kV must be double grounded.

Working Restrictions for Overhead Electrical Utilities

- Minimum setbacks, as directed by LIPA, for all boom and trucks operating in the vicinity of energized overhead lines will be maintained at all times.
- Personnel working within close proximity of energized conductors without any mechanical means will maintain the minimum physical clearance distance of 5 feet.
- National Grid and LIPA must be consulted to ensure overhead electrical lines are de-energized prior to work beneath them within the Minimum Approach Distance (MAD).
- Trucks will not be loaded or emptied/dumped under the overhead electrical lines, unless approved by National Grid/LIPA.
- Truck covers will not be opened under the overhead electrical lines.

Additional LIPA requirements for working in and around electrical substations include:

- Gate to substation must remain closed and locked unless access is granted and observed by LIPA or LIPA-approved personnel
- Safety vests cannot have any zippers (Nomex vests are recommended)
- Be aware of exposed cables, transformers and other electrical structures. Many of these are not insulated and are at ground level or a level within bodily reach.
- Equipment in control houses may be exposed/uninsulated.
- LIPA oversight personnel must be notified if a lever is hit or touched. Do not turn the lever back to its original position.

Site personnel will assume that all electrical equipment at surface, subsurface, and overhead locations is energized, until the equipment has been designated as de-energized by a LIPA representative. LIPA representatives will be responsible for de-energizing and lock out/tag out of all electrical equipment. If the equipment cannot be de-energized, work will stop and the Field Representative (FR) and/or SSO will consult with the GEI Project Manager (PM) and CHSO. All GEI employees will use proper PPE when working within the active substation including EH-rated safety boots, a hardhat, rubber gloves, and arc flash rated clothing that meet NFPA 70E standards. GEI will notify National Grid prior to working adjacent to this equipment, and will verify that the equipment is energized or de-energized.

All power lines, which have been indicated by National Grid to be de-energized must be locked out by a LIPA representative, such that the lines cannot be energized when personnel are working near them. The lines shall not be unlocked and re-energized until GEI notifies National Grid that they have completed work in the area and that all personnel are clear of the area. National Grid representatives will provide GEI personnel with site-specific lockout/tagout documentation prior to on-site activities.

If power lines cannot be de-energized, the SSO will consult with National Grid and the CHSO to discuss how to proceed. Work tasks will only commence after determination that a

safe working distance can be maintained and all personnel working in the area have been informed of the limitation. All work performed within the substation boundaries requires the use of task-specific PPE, as described in Section 12.

The subcontractor should verify that all electric, gas, water, steam, sewer, and other utility service lines are located and marked before any intrusive work is started. GEI must verify that the subcontractor has completed a utility mark out checklist prior to intrusive work in accordance with the SMP. In each case, any utility company that is involved should be notified in advance by the subcontractor according to markout procedures, and its approval or services, if necessary, shall be obtained.

The potential hazards for this project are listed in the following Activity Hazard Analysis and Site Hazards sections.

Smoking is prohibited at or in the vicinity of hazardous operations or materials.

Activity Hazard Analysis

Activity: Groundwater and Soil Sampling		
Task	**Potential Hazard**	**Control Measure**
Groundwater and soil sample collection.	Traffic	Follow traffic safety guidelines in **Appendix F**.
	Contaminant Contact	Wear proper PPE during sampling including nitrile gloves and safety glasses. Dispose of gloves after use and wash hands.
	Insect Bites	Use insect repellant. Avoid areas where insects may be prevalent.
	Slips, Trips and Falls	Keep trafficked areas free of slip/trip/fall hazards.
	Heavy Lifting-Strains and Sprains	Use proper lifting techniques. Ask fellow worker for help .
	Poisonous Plants	Avoid brush areas. Staff should be able to identify common poisonous plants.
	Wild Animals	Avoid contact with wild animals.
	Noise	Wear hearing protection.
	Electrical Substation Proximity	Wear proper PPE when working within close distance of substation. Follow National Grid, LIPA and OSHA guidelines for working distance to equipment.
Waste Characterization Sampling	Contaminant Contact	Wear proper PPE during sampling

		including nitrile gloves and safety glasses. Dispose of gloves after use and wash hands.
	Cuts or abrasions (handling drums)	Wear work gloves over nitrile gloves.
	Traffic	Follow traffic safety guidelines in **Appendix F**.
	Electrical Substation Proximity	Wear proper PPE when working within close distance of substation. Follow National Grid, LIPA and OSHA guidelines for working distance to equipment.
Drum Removal	Contaminant Contact	Wear proper PPE during sampling including nitrile gloves and safety glasses. Dispose of gloves after use and wash hands.
	Cuts or abrasions (handling drums)	Wear work gloves over nitrile gloves.
	Heavy Lifting-Strains and Sprains	Use proper lifting techniques and equipment for the job. Ask fellow worker for help.
	Electrical Substation Proximity	Wear proper PPE when working within close distance of substation. Follow National Grid, LIPA and OSHA guidelines for working distance to equipment.

Activity: DNAPL Gauging and Recovery		
Task	**Potential Hazard**	**Control Measure**
DNAPL Gauging & Recovery	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.
	Contaminant Contact	Wear proper PPE during sampling including nitrile gloves, face shield (recovery only) and safety glasses as needed. Dispose of gloves after use and wash hands.
	Slips, Trips, and Falls	Keep trafficked areas free of slip/trip/fall hazards.
	Electrical Substation Proximity	Wear proper PPE when working within close distance of substation. Follow National Grid, LIPA and OSHA guidelines for working distance to equipment.

Activity: Installation/Abandonment/Maintenance of Groundwater Monitoring Wells, and/or Other Sample Points		
Task	**Potential Hazard**	**Control Measure**
Oversight for monitoring well and/or other sample point installation and abandonment. Replacement of well boxes and associated concrete on sample points.	Contaminant Contact	Wear proper PPE including nitrile gloves and safety glasses. Dispose of gloves after use and wash hands.
	Slips, Trips, and Falls	Keep trafficked areas free of slip/trip/fall hazards.
	Silica Dust Inhalation (From Grout/Cement Mixing)	Stay upwind of mixing area. Wear a dust mask if necessary. Use dust control measures.
	Drill Rig Proximity (Pinch Points, Crushing, Non-Secure Equipment)	Maintain awareness of location of equipment. Subcontractor use of a spotter for equipment operation. Do not work near equipment unless necessary.
	Noise	Wear hearing protection.
	Jackhammer Proximity (Debris, Crushing, Pinch Points)	Wear proper PPE, including impact resistant safety glasses. Maintain awareness of location of equipment.
Waste Management	Contaminant Contact	Wear proper PPE including nitrile gloves and safety glasses. Dispose of gloves after use and wash hands.
	Cuts or Abrasions (Handling Drums)	Wear work gloves over nitrile gloves.
Trenching Oversight	Cave Ins, Objects Rolling Into Trench Traffic	Verify that appropriate trenching guidelines are being followed. Follow traffic safety guidelines in **Appendix F**.
	Exposure of Underground Utilities	Utility location should be carried out prior to start of project.
	Electrical Substation Proximity	Wear proper PPE when working within close distance of substation. Follow National Grid, LIPA and OSHA guidelines for working distance to equipment.

Activity: Site Investigations/Site Remediations		
Task	**Potential Hazard**	**Control Measure**
Excavation and Trenching Oversight	Silica Dust Inhalation (From Concrete Break-Up, Grout/Cement Mixing)	Stay upwind of concrete break-up and grout mixing areas. Use water mist to control dust. Wear a dust mask if necessary.
	Loud Noise	Wear hearing protection.
	Proximity of Impacted Stockpiles	Maintain safe distance from stockpiles. Wear respiratory protection if necessary.
	Heavy Equipment Operations (Debris, Crushing, Pinch Points)	Wear proper PPE, including impact resistant safety glasses. Maintain awareness of location of equipment. Make eye-contact with operators to make sure they are aware of your position when navigating in the vicinity of heavy equipment.
	Slips, Trips and Falls	Keep trafficked areas free of slip/trip/fall hazards. Maintain awareness of excavation and trench perimeters.
	Traffic	Follow traffic safety guidelines in **Appendix F**
	Contaminant Contact	. Wear proper PPE including nitrile gloves and safety glasses. Dispose of gloves after use and wash hands.
	Electrical Substation Proximity	Wear proper PPE when working within close distance of substation. Follow National Grid, LIPA and OSHA guidelines for working distance to equipment.

Site-Wide Potential Hazards	Control Measures
Inclement Weather	Weather reports, proper clothing, and work stoppage.
Heat/Cold Stress	Proper clothing, acclimatization, regular work breaks, fluid intake, watch for signs of heat/cold stress.

1.5 Evaluation of Potential 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. Table 1-1 presents chemical data regarding potential exposure and monitoring for the chemical types listed below. Chemicals defined as "present" or "not present" at the site were determined based upon post-remediation data that reflects the current state of contaminants monitored at the site.

1.5.1 Volatile Organic Compounds (VOCs)

VOCs, such as benzene, toluene, ethyl benzene, and xylene (BTEX) are present in soil and groundwater and in some cases chemical components in non-aqueous phase liquids (NAPL) such as oil or tar within soils and underground structures. At high concentrations, 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.

1.5.2 Coal Tar and Coal Tar Products

Coal tar products, which are semi-volatile organic compounds (SVOCs), typically consist of a mixture of:

acenaphthene	chrysene
acenaphthylene	dibenz(a,h)anthracene
anthracene	fluoranthene
benz(a)anthracene	fluorene
benzo(b)fluoranthene	indeno(1,2,3cd)pyrene
benzo(k)fluorethene	2-methyl naphthalene
benz(a)pyrene	naphththalene
benzo(e)pyrene	phenanthrene
benzo(g,h,i)peryline	Phenols
	pyrene

Coal tar products and other SVOCs are present at the site within impacted soil and groundwater and as a DNAPL by-product of gas production within soils, former 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. Details for monitoring procedures can be found in Section 2.

1.5.3 Heavy Metals

The Site potentially contains elevated levels of metals.

As with VOCs, the primary route of exposure is through inhalation of dust particles when soil is disturbed and becomes airborne.

1.5.4 Asbestos-Containing Materials

As asbestos containing materials (ACM) have not been identified onsite, they are not currently monitored for at the site.

1.5.5 Polychlorinated Biphenyls

As polychlorinated Biphenyls (PCBs) have not been identified onsite, they are not currently monitored for at the site.

1.5.6 Cyanide

Cyanide compounds are common by-products of manufactured gas production. Hydrogen cyanide is toxic because it is a chemical asphyxiant. It replaces the oxygen in the blood and thereby suffocates the cells. Ferrocyanides are not considered toxic because the hydrogen cyanide ion is bound to 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 ferrocyanide molecule. Therefore, hydrogen cyanide is not a concern at the Site. However, it is National Grid policy to monitor for hydrogen cyanide in the work zone during earth-disturbing activities at sites where MGP-related contaminants have been found.

1.5.7 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 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.

1.5.8 Evaluation of Organic Vapor Exposure

During intrusive activities, the requirement for 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 2. Air monitoring will be conducted during intrusive activities (such as drilling) and PID screening of well head spaces will be conducted during groundwater sampling activities.

Exposure to organic vapors shall be evaluated and/or controlled by:

- Monitoring air concentrations for organic vapors in the breathing zone with a photo-ionization detector (PID).
- 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 or other 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.

Specific chemical hazards information from the Material Safety Data Sheet (MSDS) and Occupational Health Guidelines are summarized in Table 1-1. MSDSs for decontamination chemicals, calibration gases, sample preservation chemicals, or other chemicals that may be used onsite, are kept in a separate MSDS binder onsite.

Table 1-1
Chemical Data

Compound	CAS #	American Conference of Industrial Hygienists (ACGIH) threshold limit value (TLV)	OSHA personal exposure limit (PEL)	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Arsenic	7440-38-2	0.01 mg/m^3	0.01 mg/m^3	Inhalation Skin Absorption Ingestion Skin Contact	Ulceration of nasal septum, derm, GI disturbances, peripheral neuropathy, resp. irritation, hyperpigmentation of skin, potential carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Metal: Silver-gray or tin-white, brittle, odorless solid FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm
Benzene	71-43-2	0.5 ppm (Skin)	1 parts per million (ppm) time weighted average (TWA) 5 ppm Short term exposure limit (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, known human carcinogen	Eyes, skin, central nervous system (CNS), bone marrow, blood	Flashpoint (FP): 12^o F lower explosive limit (LEL): 1.2% Upper explosive limit (UEL):7.8% Vapor pressure (VP): 75 mm
Copper	7440-50-8	1.0 mg/m^3	1.0 mg/m^3	Inhalation Ingestion Skin Contact	Irritation of eyes, nose, pharynx; nasal septum perf; metallic taste, skin irritation	Respiratory system, eyes, skin, liver, kidneys (increase risk with Wilson's disease)	Reddish, lustrous, malleable, odorless solid 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^o F LEL: 0.8% UEL:6.7% VP: 7 mm

Table 1-1
Chemical Data

Compound	CAS #	American Conference of Industrial Hygienists (ACGIH) threshold limit value (TLV)	OSHA personal exposure limit (PEL)	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Hydrogen cyanide	74-90-8	4.7 ppm (5 milligrams per cubic meter [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, Cardiovascular system, thyroid, blood	Colorless or pale-blue liquid or gas (above 78°F) with a bitter, almond-like odor. VP: 630 mmHg
Hydrogen sulfide	7783-06-4	10 ppm TWA, 15 ppm STEL	20 ppm continuous, 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
Iron	7439-89-6	1.0 mg/m^3	NA	Inhalation Ingestion Skin Contact	Irritation of eyes, skin, mucus membrane, abdominal pain, diarrhea, vomit, possible liver damage	Eyes, skin, respiratory system, liver, GI tract	Appearance and odor vary dependent upon specific soluble iron salt. FP: NA IP: NA LEL: NA UEL: NA VP: 4 mm

Table 1-1
Chemical Data

Compound	CAS #	American Conference of Industrial Hygienists (ACGIH) threshold limit value (TLV)	OSHA personal exposure limit (PEL)	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
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, Central Nervous System, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. FP: NA LEL: NA UEL: NA VP: 0 mm
Manganese	7439-96-5	TWA 1 mg/m^3 ST 3 mg/m^3	C 5 mg/m^3	Inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	Respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid. FP: NA LEL: NA UEL: Na VP: 0 mmHg
Naphthalene	91-20-3		10 ppm (50 mg/m3) 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

Table 1-1
Chemical Data

Compound	CAS #	American Conference of Industrial Hygienists (ACGIH) threshold limit value (TLV)	OSHA personal exposure limit (PEL)	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
PAHs as Volatiles and Semi-Volatiles	65996-93-2	0.2 mg/m3	0.2 mg/m^3	Inhalation Skin contact Ingestion	Irritant to eyes, swelling, acne contact dermatitis, chronic bronchitis	Respiratory system, Central Nervous System, liver, kidneys, skin, bladder,	Black or dark brown amorphous residue.
Selenium	7782-49-2	0.2 mg/m^3	0.2 mg/m^3	Inhalation Ingestion Skin Contact	Irritant to eyes, skin, nose and throat, visual disturbance, headache, chills, fever, breathing difficulty, bronchitis, metallic taste, garlic breath, GI disturbance, dermatitis, eye and skin burns,	Eyes, skin, respiratory system, liver, kidneys, blood spleen	Amphorous or crystalline, red to gray solid FP: NA LEL: NA UEL: NA VP: 0 mm
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, Central Nervous System, liver, kidneys	FP: 40^o F LEL: 1.1% UEL:7.1% VP: 21 mm
Xylene	1330-20-7	100 ppm	100 ppm	Inhalation Skin Absorption Ingestion Skin Contact	Eye, skin, nose, throat irritation; dizziness, excitement, drowsiness; lack of coordination, 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^o F LEL: 0.9% UEL: 6.7% VP: 9 mm

Table 1-1
Chemical Data

Compound	CAS #	American Conference of Industrial Hygienists (ACGIH) threshold limit value (TLV)	OSHA personal exposure limit (PEL)	Route of Exposure	Symptoms of Exposure	Target Organs	Physical Data
Zinc	1314-13-2	5.0 mg/m^3	5.0 mg/m^3	Inhalation	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; weak, lass; metallic taste; head; blurred vision; low back pain; vomit; fatigue; malaise; tight chest; dysphoria, decreased pulmonary function	Respiratory System	White odorless solid. FP: NA IP: NA LEL: NA UEL: NA VP: 0 mm

Abbreviations	
C = ceiling limit, not to be exceeded	LEL = Lower explosive limit
CNS = Central Nervous System	mm = millimeter
CVS = Cardiovascular System	ppm = parts per million
eV = electron volt	Skin = significant route of exposure
FP = Flash point	STEL = Short-term exposure limit (15 minutes)
IP = Ionization Potential	TWA = Time-weighted average (8 hours)
GI = Gastro-intestinal	UEL = Upper explosive limit
mg/m^3= milligrams per cubic meter	VP = vapor pressure approximately 68° F in mm Hg (mercury)

1.6 Biological Hazards

During the course of the project, there is a potential for workers to come into contact with biological hazards such as animals, insects and plants. Workers will be instructed in hazard recognition, health hazards, and control measures during site-specific training.

1.6.1 Animals

During the conduct of site operations, wild animals such as stray dogs or cats, raccoons, and mice may be encountered. Workers shall use discretion and avoid all contact with wild 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.

1.6.2 Insects

Insects, including bees, wasps, hornets, and spiders, may be present at the Site making the chance of a bite possible. Some individuals may have a severe allergic reaction to an insect bite or sting that can result in a life threatening condition. Any individuals who have been bitten or stung by an insect should notify the SSO. The following is a list of preventive measures:

- Apply insect repellent prior to performing any field work and as often as needed throughout the work shift.
- Wear proper protective clothing (work boots, socks and light colored pants).
- 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 onsite and should provide this information to the SSO prior to commencing work.

1.6.2.1 Tick Borne Illnesses

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 that could lead to the worker contracting Lyme disease.

Lyme disease may cause a variety of medical conditions including arthritis, which can be treated successfully if the symptoms are recognized early and medical attention is received. Treatment with antibodies has been successful in preventing more serious symptoms from developing. Early signs may include a flu-like illness, an expanding skin rash, and joint pain. If left untreated, Lyme disease can cause serious nerve or heart problems, as well as a disabling type of arthritis.

Symptoms can include a stiff neck, chills, fever, sore throat, headache, fatigue and joint pain. This flu-like illness is out of season, commonly happening between May and October when ticks are most active. A large expanding skin rash may develop around the area of the bite. More than one rash may occur. The rash may feel hot to the touch and may be painful. Rashes vary in size, shape, and color, but often look like a red ring with a clear center. The outer edges expand

in size. It's easy to miss the rash and the connection between the rash and a tick bite. The rash develops from three days to as long as a month after the tick bite. Almost one third of those with Lyme disease never get the rash.

Joint or muscle pain may be an early sign of Lyme disease. These aches and pains may be easy to confuse with the pain that comes with other types of arthritis. However, unlike many other types of arthritis, this pain seems to move or travel from joint to joint.

Lyme disease can affect the nervous system. Symptoms include stiff neck, severe headache, and fatigue usually linked to meningitis. Symptoms may also include pain and drooping of the muscles on the face, called Bell's Palsy. Lyme disease may also mimic symptoms of multiple sclerosis or other types of paralysis.

The disease can also cause serious but reversible heart problems, such as irregular heartbeat. Finally, Lyme disease can result in a disabling, chronic type of arthritis that most often affects the knees. Treatment is more difficult and less successful in later stages. Often, the effects of Lyme disease may be confused with other medical problems.

It is recommended that personnel 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 tick is found biting an individual, the PM should be contacted immediately. The tick can be removed by pulling gently at the head with tweezers. The affected area should then be disinfected with an antiseptic wipe. The employee will be offered the option for medical treatment by a physician, which typically involves prophylactic antibiotics. If personnel feel sick or have signs similar to those above, they should notify the PM immediately.

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).

1.6.3 Plants

The potential for contact with poisonous plants exists when performing field work in undeveloped and wooded areas. Poison ivy, sumac, and oak may be present onsite. 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 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 oak can be present as a sparingly branched shrub. Poison oak is similar to poison ivy in that it has the same leaflet configuration; however, the leaves have slightly deeper notches. Prophylactic application of Tecnu may prevent the occurrence of exposure symptoms. Post exposure over the counter products are available and should be identified at the local pharmacist. Susceptible individuals should be identified to the PM.

Contact with poison ivy, sumac, or oak may lead to a skin rash, characterized by reddened, itchy, blistering skin which needs first aid treatment. If a field worker believes they 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.

1.7 Personal Safety

Field activities have the potential to take site workers into areas which may pose a risk to personal safety. The following website (source) has been researched to identify potential crime activity in the area of the project:

- http://www.nyc.gov/html/nypd/html/crime_prevention/crime_statistics.shtml

2011 crime statistics from this website report that the 100th precinct, which encompasses Rockaway Park, NY, recorded all crimes below the NY City total (see below).

Type of Crime	Rockaway Park & Vicinity	New York City Total*
Murder	1	515
Rape	5	1421
Robbery	86	19,714
Felony Assault	130	18,477
Burglary	138	18,716
Grand Larceny	145	38,501

*New York City Total includes values from Rockaway Park & Vicinity.

To protect yourself, take the following precautions:

- 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.

Site workers must not knowingly enter into a situation where there is the potential for physical and violent behaviors to occur. If site workers 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 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 and site worker safety will be confirmed at the start, mid-point, and near the end of each working day.

2. Air Monitoring

Air monitoring shall 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. Work requiring air monitoring includes the installation and/or abandonment of monitoring wells, sample points, and DNAPL recovery wells.

GEI may conduct perimeter air monitoring, and work zone monitoring for onsite workers 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 (FR) of results. If action levels are exceeded, the PM and the CHSO will be notified.

GEI will provide the following equipment for health and safety monitoring of onsite personnel:

- PID with 10.6 eV lamp or equivalent
- Drager Chip Measurement System (CMS) with appropriate gas detection chips
- Dust Meter
- Mutli-Gas Meter: Combustible Gas Indicator (CGI) / Oxygen (O2) / Hydrogen Sulfide (H_2S) / Hydrogen Cyanide (HCN) meter
- Sound Level Meter if deemed necessary by the PM and CHSO, type to be appropriate to the activities performed.

All air monitoring equipment will be calibrated and maintained in accordance with manufacturer's requirements. All calibrations will be recorded in the project notes daily or on a daily calibration form.

Organic vapor concentrations will be measured using the PID during intrusive activities. During intrusive operations, organic vapor concentrations shall 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 FR 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 shall be used to monitor for combustible gases and oxygen content during intrusive activities. The meter will also be equipped with an H_2S sensor and an HCN sensor. H_2S and HCN monitoring will be conducted concurrently with atmospheric monitoring for oxygen and combustible gases on a continuous basis. Staff conducting air monitoring should note that a sulfur-like odor may indicate the presence of H_2S, and that a bitter almond odor may indicate the presence of HCN.

Perimeter and work zone air monitoring will be conducted during intrusive activities such as monitoring well installation and abandonment, recovery well installation and abandonment, soil borings and groundwater probes. Table 2-1 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 the Occupational Safety and Health Administration (OSHA) and the American Conference of Government Industrial Hygienists (ACGIH). Oxygen values are based on the maximum use limits of a full face respirator if oxygen were being displaced by a chemical.

TABLE 2-1
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 determine if concentration is benzene. If benzene is detected, stop work, withdraw from the work area and notify the SSO and CHSO.
PID	Work Zone	1 – 10 ppm	If benzene is not detected, used colorimetric detector to measure for the presence of naphthalene. If naphthalene is detected, stop work, withdraw from the work area, and notify the SSO and CHSO.
		10 – 50 ppm	If benzene is not detected, no respiratory protection is required
		50 – 100 ppm	Stop work, withdrawal from work area, institute engineering controls, if levels reach 100 ppm upgrade to Level C
		> 100 ppm	Stop work, withdraw from work area; notify SSO & CHSO
Oxygen meter	Work Zone	< 20.7%	Stop work; withdraw from work area; ventilate area, notify SSO & CHSO.
		> 21.1%	Stop work; withdraw from work area; notify SSO & CHSO.
H_2S meter	Work Zone	<5 ppm	No respiratory protection is required
		>5 ppm	Stop work, cover excavation, withdraw from work area, institute engineering controls, notify SSO & CHSO
HCN meter	Work 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 2ppm.
		1.0< HCN Conc.<2.0 ppm	Run CMS Drager tube and confirm concentration is less than 2.0 ppm, notify SSO and CHSO. Run CMS 28 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 least 25 ppm upwind of the excavation until continuous meter reads less than 1 ppm, Notify SSO & 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 SSO & 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

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.
- Minimize GEI employees' work exposure to potential physical, chemical, and biological hazards.

3. Key Project Personnel/Responsibilities and Lines of Authority

GEI Personnel		
Matt O' Neil	OU-1 Task Manager	Office: 401-533-5152 Cell: 860-608-9725
Chris Morris	Field Operations Manager Site Safety Officer (or designee)	Office: 631-759-2967 Cell: 631-484-9152
Devin Byrne	Field Staff Lead	Office: 631-759-2972 Cell: 631-513-0337
Tess Landgraff	Local Health and Safety Coordinator	Office: 631-759-2963 Cell: 631-356-2287
Steve Hawkins	Regional Health and Safety Officer (RHSO)	Office: 860-368-5348 Cell: 860-916-4167
Robin DeHate	Corporate Health and Safety Officer (CHSO)	Office: 813-774-6564 Cell: 813-323-6220

Lines of Authority will be as follows:

Onsite – GEI will have responsibility for safety of its employees during the work performed at the site. GEI's FR will have a cell phone available to contact the appropriate local authorities, in the event of an emergency. The FR will be available for communication with the SSO and PM and with the National Grid representative. The FR and/or SSO may change due to the nature of work being conducted onsite.

3.1 Project Manager (PM)

Responsibilities of the PM include the following:

- Verifies implementation of the HASP
- Conducts periodic inspections and documents these in the field book
- Participates in incident investigations
- Verifies the HASP has all of the required approvals before any site work is conducted

- Verifies that the National Grid site manager is informed of project changes, which require modifications of the HASP
- Has overall responsibility for project health and safety
- Acts as the primary point of contact with National Grid for site related activities and coordination with non-project related site operations
- Overseeing of performance of project tasks as outlined in the scope of work
- Plans field work using appropriate safe procedures and equipment
- Verifies and documents current training and medical monitoring clearance for GEI project staff
- Verifies that subcontractor has a site-specific HASP

3.2 Corporate Health and Safety Officer (CHSO)

The CHSO is a qualified health and safety professional with experience in hazardous waste site remediation activities. Responsibilities of the CHSO include the following:

- Provides support for the development and approval of the HASP
- Serves as the primary contact to review health and safety matters that may arise
- Approves revised or new safety protocols for field operations
- Coordinates revisions of this HASP with field personnel
- Coordinates upgrading or downgrading of PPE with the site manager
- Leads the investigation of all accidents/incidents
- Provide the necessary training of GEI field crews in accordance with OSHA regulations and provides proof of training to the SSO prior to GEI personnel entering the site

3.3 Site Safety Officer (SSO)

Responsibilities of the SSO include the following:

- Verifies that the HASP is implemented and that all health and safety activities identified in the HASP are conducted and/or implemented
- Verifies that field work is scheduled with adequate personnel and equipment resources to complete the job safely and enforces site health and safety rules
- Verifies that adequate communications between field crews and emergency response personnel is maintained during emergency situations
- Verifies that field site personnel are adequately trained and qualified to work at the site and that proper PPE is utilized by field teams
- Investigate and report all accidents/incidents to the CHSO and PM
- Stop work if necessary
- Identifies operational changes which require modifications to the HASP and ensures that the procedure modifications are implemented and documented through changes to the HASP, with CHSO and National Grid approval
- Determines upgrades or downgrades of PPE based on site conditions and/or real-time monitoring results with CHSO and National Grid approval
- Reports to the CHSO and provides summaries of field operations and progress

3.4 Field Representative (FR)

The FR is responsible for carrying out field work on a monthly, quarterly, or as-needed basis. Responsibilities of the FR include:

- Conducts routine safety inspection of the work area
- Documenting occurrences of unsafe activity and what actions were taken to rectify the situation
- Reports any unsafe or potentially hazardous conditions to the SSO and PM
- Maintains familiarity of the information, instructions, and emergency response actions contained in the HASP
- Complies with rules, regulations and procedures set forth in the HASP
- Prevents admittance to work site by unauthorized personnel
- Inspects all tools and equipment, including PPE, prior to use and documents inspection on the daily safety meeting form or in the appropriate field book
- Ensures that monitoring instruments are calibrated
- Stops work if necessary

4. Subcontractors

GEI subcontracts with various companies to conduct various work onsite on an as-needed basis. Contact information for these subcontractors will be available when such work is being conducted.

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 and must adhere to applicable requirements set forth in this HASP. GEI will verify that its subcontractor's HASP includes National Grid's site specific requirements as outlined in this HASP.

5. Emergency Contact List

<table>
<tr><th colspan="3">EMERGENCY INFORMATION</th></tr>
<tr><td colspan="2">Important Phone Numbers</td><td>Directions to:
St. John’s Episcopal Hospital
327 Beach 19th Street
Far Rockaway, New York 11691</td></tr>
<tr><td>Police</td><td>911</td><td rowspan="6">Head east on Beach Channel Drive for 1.7 miles and turn right onto Beach 73rd Street. Go 210 feet and turn left onto Rockaway Freeway. Continue for1.9 miles and turn right onto Seagirt Boulevard. Go 0.7 miles and turn left onto Beach 19th Street. Continue on for 0.2 miles and the hospital will be on the left.
.

Refer to Hospital Route Map in Appendix A.</td></tr>
<tr><td>Fire Department</td><td>911</td></tr>
<tr><td>Ambulance</td><td>911</td></tr>
<tr><td>Occupational Health Clinic
Land, Sea & Air Medical Review Specialists</td><td>(631) 225-3060
(Directions can be found in Appendix A)</td></tr>
<tr><td>St. John’s Episcopal Hospital</td><td>General
(718) 869-7000
Emergency
(718) 869-7755</td></tr>
<tr><td>NYSDEC Spill Hotline</td><td>(518) 457-7362</td></tr>
<tr><td>Chemtrec</td><td>1-800-424-9300</td><td>Poison Control Center 1-800-222-1222</td></tr>
<tr><td>Project Manager</td><td>Matt O’Neil</td><td>(631) 513-7191 cell
(631) 759-2964 office</td></tr>
<tr><td>Field Operations Manager</td><td>Chris Morris</td><td>(631) 484-9152 cell
(631) 759-2967 office</td></tr>
<tr><td>Field Staff Lead</td><td>Devin Byrne</td><td>(631) 759-2972 cell
(631) 759-2972 office</td></tr>
<tr><td>Corporate H&S Officer</td><td>Robin DeHate</td><td>(813) 323-6220 cell
(813) 774-6564 office</td></tr>
<tr><td>Regional H&S Officer</td><td>Steve Hawkins</td><td>(860) 916-4167 cell
(860) 368-5348 office</td></tr>
<tr><td>Local H&S Coordinator</td><td>Tess Landgraff</td><td>(631) 356-2287 cell
(631) 759-2965 office</td></tr>
<tr><td colspan="3">Client Contacts</td></tr>
<tr><td>Thomas Campbell</td><td colspan="2">(516) 545-2555-office (917)-734-3396-cell</td></tr>
</table>

6. Training Program

6.1 HAZWOPER Training

In accordance with 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste operations and emergency response (HAZWOPER). At a minimum, the training shall have consisted of instruction in the topics outlined in the standard and can include applicable sections of 29 CFR 1926. Personnel who have not met the requirements for initial training shall not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical). Proof of training shall be submitted to the CHSO or her representative prior to the start of field activities.

6.2 Annual Eight-Hour Refresher Training

Annual eight-hour refresher training will be required of all 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 shall be submitted to the CHSO or her representative prior to the start of field activities.

6.3 First Aid, CPR, Blood-borne Pathogens

The PM will identify individuals certified in first aid and CPR, or identify individuals for such training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross Association. In conjunction with the first aid and CPR training, as well as during annual GEI health and safety training, GEI employees receive blood-borne pathogen training. All GEI personnel working on site will have current First Aid and CPR training.

6.4 Site-Specific Training

Prior to commencement of field activities, the CHSO or her representative will ensure all field personnel assigned to the project are familiarized with the activities, procedures, monitoring, and equipment used in the site operations. This includes site and facility layout, hazards associated with site tasks and activities, and emergency services at the site and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity. Personnel that have not received site-specific training will not be allowed onsite.

6.5 Supervisor Training

Personnel acting in a supervisory capacity will have received 8 hours of instruction in addition to the initial 40 hours training. In addition, supervisors will have 1 year of field experience and training specific to work activities (i.e., sampling, construction observation, etc.).

6.6 Onsite Safety Briefings

Other onsite GEI personnel will be given health and safety briefings by a FR to assist GEI personnel in safely conducting work activities. The briefings will 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. The meetings will also be an opportunity to periodically update the workers on monitoring results. These safety briefing will be documented in the GEI field book or on the daily safety briefing form.

7. 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 all branch office locations. Comprehensive examinations are given to all GEI field personnel participating in hazardous waste operations on an annual or biennial basis (as determined to be appropriate by the CHSO). The medical results of the examinations aid in determining the overall fitness of employees participating in field activities.

Under the CHSO's supervision, all 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 all levels of respiratory protection, in particular.

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.

All GEI subcontractor personnel that will enter any active waste handling or other potentially impacted 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 shall be submitted to the CHSO or their representative prior to the start of field activities.

8. Site Control Measures

8.1 Site Zones

During intrusive activities, site zones are intended to control the potential spread of contamination and to assure that only authorized individuals are permitted into potentially hazardous areas. Barricade tape and cones will be used to designate work zone areas. Decontamination will be conducted as outlined in Section 12. If any heavily contaminated soils are encountered during intrusive work, separate wash areas for heavy equipment and personal PPE will be established.

9. Incident 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 shall be made to the GEI PM verbally within 2 hours of the incident. The PM will immediately inform the CHSO, the Director of Human Resources and a Project-Specific National Grid Representative for the incident. The Project-Specific National Grid Representative will be immediately notified with a phone call. An Incident Report Form (see **Appendix E**) will be completed and submitted to the CHSO and the Project-Specific National Grid Representative within 24 hours.

10. Medical Support

In case of minor injuries, onsite care shall be administered with the Site first aid kit. Staff may also go to the nearest occupational health provider (Land, Sea & Air Medical Review Specialists) located at 910 Route 109, in North Lindenhurst, NY. Directions to Land, Sea & Air can be found in **Appendix A**.

For serious injuries, call 911 and request emergency medical assistance. Seriously injured persons should not be moved, unless they are in immediate danger.

Section 5 and **Appendix A** contain detailed emergency information, including directions to the nearest hospital, and a list of emergency services and their telephone numbers. GEI field personnel will carry a cellular telephone.

11. Decontamination Procedures

11.1 Personnel Decontamination Station

As needed, a personnel decontamination station where workers can drop equipment and remove PPE will be set up at the decontamination pad by the Contractor when intrusive activities are conducted at the site. 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 portable sink where

they will wash themselves wherever they have potentially been exposed to any contaminants (e.g., hands, face, etc.).

Contaminated PPE (gloves, suits, etc.) will be decontaminated and stored for reuse or placed in plastic bags (or other appropriate container) and disposed of in an approved facility. Decontamination wastewater and used cleaning fluids will be collected and disposed of in accordance with all applicable state and federal regulations.

11.2 Decontamination Equipment Requirements

If heavily contaminated soils are encountered during intrusive work, the following equipment, as needed, will be in sufficient supply to implement decontamination procedures for GEI's equipment.

- Buckets
- Alconox™ detergent concentrate
- Hand pump sprayers
- Long handle soft bristle brushes
- Large sponges
- Cleaning wipes for respirators
- Bench or stool(s)
- Methanol
- Liquid detergent and paper towels
- Plastic trash bags

12. Personal Protective Equipment

PPE required for each level of protection is as follows.

Safety Equipment	Level A	Level B	Level C	Level D
Tyvek® suit or work overalls as appropriate for work being performed and materials handled				•
Hard hats with splash shields or safety glasses			•	•
Steel-toe boots with overboots as appropriate for work being performed and materials handled			•	•
Chemical-resistant gloves			•	•
Reflective Vest			•	•
Half- or full-face respirators with HEPA cartridges as approved by the CHSO			•	
Tyvek® splash-resistant suit			•	
Chemical-resistant clothing		•		
Long Pants	•	•	•	•
Pressure-demand, full-face SCBA or pressure-demand supplied air respirator with escape SCBA	•	•		
Inner and outer chemical-resistant gloves	•	•		
Chemical-resistant safety boots or shoes	•	•		
Two-way radio	•	•		
Hard hat	•	•	•	•
Fully encapsulating chemical-resistant suit	•			

PPE requirements for field activities are as follows.

Activity	Level of Protection	Backup Protection
Groundwater and soil vapor monitoring	D	C
DNAPL gauging and recovery	D	C
Install/Abandon wells and sample points	D	C
Oxygen and ozone injection system check	D	C
Intrusive activities (i.e. excavation, trenching)	D	C
Soil vapor intrusion and indoor/outdoor air investigations	D	C
Site investigation and remediation	D	C
Site Maintenance	D	C

PPE can include hardhats, safety glasses or face shields, steel toe/steel shank boots, hearing protection, nitrile gloves, and leather gloves as necessary.

OSHA Requirements for PPE

All PPE used during the course of this field investigation must meet the following OSHA standards:

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

Any onsite 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 onsite personnel. The PM will obtain such information from the subcontractor's site supervisor prior to the initiation of any 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;
- IDLH concentrations; and
- If contaminant levels exceed designated use concentrations.

For most work conducted at the site, Level D PPE will include long pants, hard hats, safety glasses with side shields, and steel toe safety boots. When work is conducted in areas where NAPL or tar-saturated soil is anticipated, workers shall wear, at a minimum, modified Level D PPE, which can include Tyvec® coveralls and safety boots with overboots. The use of respirators is not anticipated.

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 work zone and this HASP will be revised with oversight of the CHSO, GEI personnel will not re-enter the work zone until conditions allow.

13. Supplemental Contingency Plan Procedures

13.1 Hazard Communication Plan

GEI personnel have received hazard communication training as part of their 40-hour HAZWOPER training. All hazardous materials used on the Site will be properly labeled, stored, and handled. MSDS will be available to onsite staff.

13.2 Fire

In the event of a fire, all personnel will evacuate the area. GEI's field representative will contact the local fire department and report the fire. Notification of evacuation will be made to the GEI PM and the CHSO. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM. **Appendix H** contains the Emergency Evacuation Plan should staff need to relocate during an emergency.

13.3 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 mph, heavy rains or snow squalls, thunderstorms, hurricanes, and lightning storms. If severe weather is approaching, the decision to evacuate GEI personnel and subcontractor personnel from the site is the responsibility of GEI's field representative. Notification of evacuation will be made to the GEI Project Manager, the CHSO, and the National Grid PM. The field representative will account for GEI personnel and subcontractor personnel and report their status to the PM.

13.4 Spills or Material Release

If a hazardous waste spill or material release, the SSO or their representative will immediately assess the magnitude and potential seriousness of the spill or release based on the following:

- MSDS, if applicable, 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
- Estimates of area under influence of release

If the spill or release is determined to be within the onsite emergency response capabilities, the SSO will ensure implementation of the necessary remedial action. If the release is beyond the capabilities of the site personnel, all 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 National Grid PM.

13.5 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.

Health and Safety Plan Sign-Off

All GEI personnel conducting site activities must read this Health and Safety Plan, be familiar with its requirements, and agree to its implementation.

All other personnel onsite for regulatory, observational and other activities not directly associated with remedial activities must read this Health and Safety Plan for hazard communication purposes.

Once the Health and Safety Plan has been read, complete this sign-off sheet, and return it to the Project Manager**.**

Site Name:
Rockaway Park Former MGP Site

Activity:

- Soil Borings
- Soil and Groundwater Sampling
- Gauging and Recovery of Dense Non-Aqueous Phase Liquids (DNAPL)
- Installation/Abandonment/Maintenance of Wells and Sample Points.

GEI Project No: 093150

I have received and read the Health and Safety Plan, been briefed on it, and agree to its implementation.

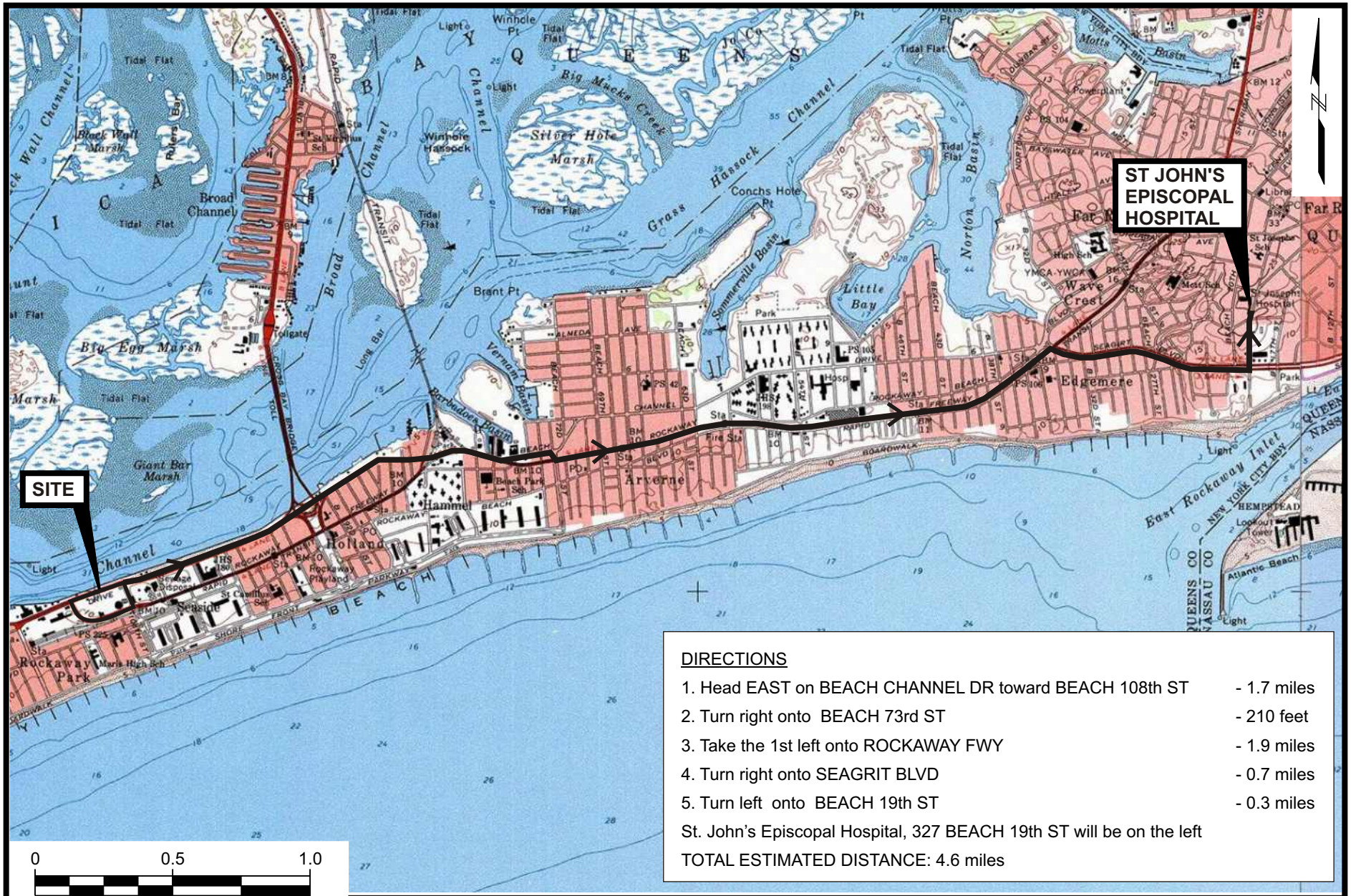
Name	Signature	Date	Company	Check if HAZCOM only

HAZCOM – Hazard Communication

Name	Signature	Date	Company	Check if HAZCOM only

APPENDIX A

SITE-SPECIFIC INFORMATION



HEALTH AND SAFETY PLAN
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

nationalgrid

GEI Consultants

Project 093150-4-1401

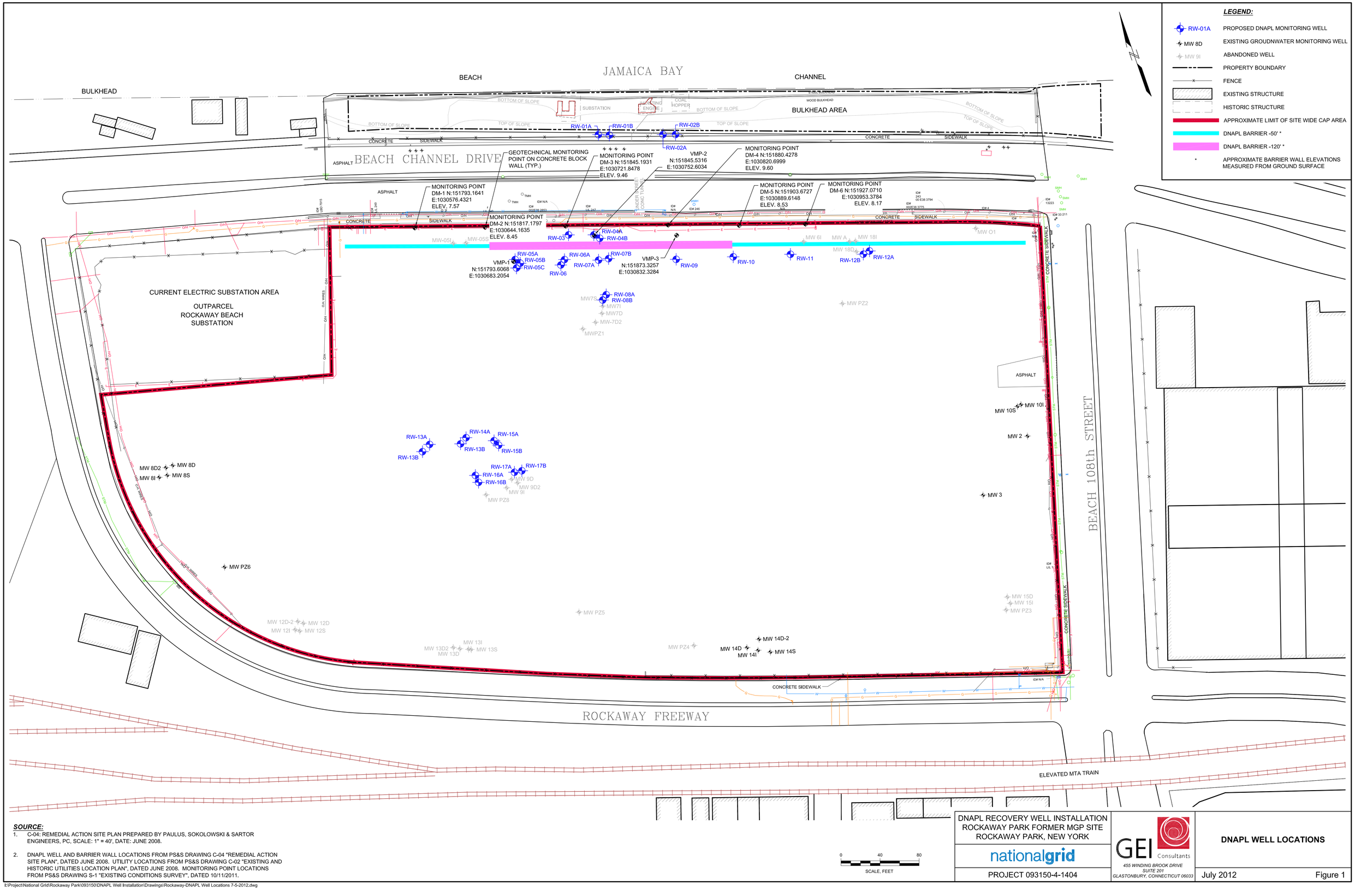
HOSPITAL ROUTE MAP

July 2012 Figure 1

NATIONAL GRID\ROCKAWAY PARK\093150\ROCKAWAY-HOSPITAL ROUTE.CDR

DIRECTIONS TO:
Occupational Health Provider
Land, Sea & Air Medical Review Specialists
910 Route 109
North Lindenhurst, NY 11757
631-225-3060

1. Head **east** on **Beach Channel Dr** toward **Beach 108th Street**	0.7 mi
2. Slight right onto the ramp to Cross Bay Boulevard	52 ft
3. Keep left at the fork, follow signs for Cross Bay Vet. Mem. Br./Belt Parkway and merge onto Cross Bay Boulevard (Partial Toll Road)	5.6 mi
4. Turn right onto the Belt Parkway East ramp towards Eastern Long Island	0.1 mi
5. Keep left at the fork and merge onto the Belt Parkway	6.8 mi
6. Continue onto **Southern State Parkway**	18.1 mi
7. Take Exit 33 to merge onto NY-109E/Farmingdale Rd toward Babylon. Continue to follow NY-109E Destination will be on the right	1.0 mi
Arrive at 910 New York 109 North Lindenhurst, NY 11757	



SOURCE:

1. C-04: REMEDIAL ACTION SITE PLAN PREPARED BY PAULUS, SOKOLOWSKI & SARTOR ENGINEERS, PC, SCALE: 1" = 40', DATE: JUNE 2008.

2. DNAPL WELL AND BARRIER WALL LOCATIONS FROM PS&S DRAWING C-04 "REMEDIAL ACTION SITE PLAN", DATED JUNE 2008. UTILITY LOCATIONS FROM PS&S DRAWING C-02 "EXISTING AND HISTORIC UTILITIES LOCATION PLAN", DATED JUNE 2008. MONITORING POINT LOCATIONS FROM PS&S DRAWING S-1 "EXISTING CONDITIONS SURVEY", DATED 10/11/2011.

DNAPL RECOVERY WELL INSTALLATION
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

nationalgrid

PROJECT 093150-4-1404

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

DNAPL WELL LOCATIONS

July 2012 Figure 1

I:\Project\National Grid\Rockaway Park\093150\DNAPL Well Installation\Drawings\Rockaway-DNAPL Well Locations 7-5-2012.dwg

APPENDIX B

COLD STRESS GUIDELINES

Cold Stress Guidelines

	Symptoms	What to do
Mild Hypothermia	• Body Temp 98-90°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 of blankets • Cover the head • Drink warm (not hot) sugary drink
Moderate Hypothermia	• Body temp 90-86°F • Shivering stops • Unable to walk or stand • Confused irrational	• All of the above, plus: • Call 911 • Cover all extremities completely • Place very warm objects, such as hot packs on the victim's head, neck, chest and groin
Severe Hypothermia	• Body temp 86-78°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 sugary drink

APPENDIX C

HEAT 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, 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, severe headache, collapse, delirium, 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 five days.

APPENDIX D

UTILITY CLEARANCE FORMS AND PROCEDURES

Utility Clearance Documentation

Client: _____

Project: _____
Site: _____
Drilling Location ID: _____
Driller: _____
GEI PM: _____
GEI Field Team Leader: _____
Utility Drawings Reviewed: _____
Provided By: _____
Reviewed By: _____
One Call 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: _____
Physical Test Pit Clearance Required (yes/no): _____
Contractor: _____ Date: _____
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: _____

Call 1-800-272-4480 TOLL FREE!

LOCATION REQUEST FORM

1. Caller's Name_____
2. Telephone Number_____
3. Contractor_____
4. Contractor 's Address_____
5. Work Date ___/___/___ Starting Work Time _____ AM or PM
6. Borough/County_____
7. Street Number_____
8. First Intersection_____
9. Second Intersection_____
10. Type of Work_____
11. Method of Excavation_____
    _____
12. Street _____ Sidewalk _____ Private Property _____

Other (specify) _____
_____

If Private Property: Front _____ Rear _____ Side _____

13. Person to contact_____
14. Telephone Number_____
15. Work Being Done For_____
16. Remarks_____
    _____
17. Serial Number_____
    _____
18. Member
    List_____
    _____

For Your Reference: Today's Date _____ Time_____

Please fill in the above info before you call, it will speed up your response.

APPENDIX E

INCIDENT REPORTING

INCIDENT REPORT FORM

Please attach photographs relating to the incident if possible.

Report No. _____

Site: _____ Project No. _____

Location: _____

Date of Report: _____ Preparer's Name: _____

Name and Address of Injured: _____

Date of Birth _____ Date of Hire: _____ Title/Classification: _____

Division/Department _____ Date of Accident _____ Time: _____

Accident Category: ___ Motor Vehicle ___ Property Damage ___ Fire

___ Chemical Exposure ___ Near Miss ___ Other

For vehicles involved in a motor vehicle incident, please fill out the following information:

MAKE: MODEL: VIN: _____PLATE NO.:_____ ___STATE:_____

MAKE: MODEL: VIN: _____PLATE NO.:_____ ___STATE:_____

MAKE: MODEL: VIN: _____PLATE NO.:_____ ___STATE:_____

MAKE: MODEL: VIN: _____PLATE NO.:_____ ___STATE:_____

Please attach photographs of the area the vehicle incident occurred in and of any damage to vehicles involved.

Severity of Injury or Illness: ____ Non-disabling ___ Disabling

____ Medical Treatment ___ Fatality

Amount of Damage: $_____ Property Damaged: _____

Estimated Number of Days Away from Job: _____

Nature of Injury or Illness: _____

CLASSIFICATION OF INJURY:

____ Fractures	____ Heat Burns	____ Cold Exposure
____ Dislocations	____ Chemical Burns	____ Frostbite
____ Sprains	____ Radiation Burns	____ Heat Stroke
____ Abrasions	____ Bruises	____ Heat Exhaustion
____ Lacerations	____ Blisters	____ Concussion
____ Punctures	____ Toxic Respiratory Exposure	____ Faint/Dizziness
____ Bites	____ Toxic Ingestions	____ Toxic Respiratory
____ Toxic Ingestions	____ Dermal Allergy	

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care Was Received: _____

Where Medical Care Was Received: _____

Address (if off-site): _____

ACCIDENT LOCATION:

Please provide a sketch of the accident location, vehicles involved, and any details as to how the accident occurred in the space below.

Causative agent most directly related to accident (object substance, material, machinery, equipment conditions):

Was weather a factor?

Unsafe mechanical/physical/environmental condition at time of accident (be specific):

Unsafe act by injured and/or others contributing to the accident (be specific, must be answered):

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue):

Level of personal protection equipment required in Site Safety Plan:

Modifications:

Was injured using required equipment?

If not, how did actual equipment use differ from plan?

What can be done to prevent a recurrence of this type of accident (modification of machine; mechanical guards; correct environment training):

Detailed narrative description (how did accident occur, why; objects, equipment, tools used, circumstance assigned duties) (be specific):

(Use separate sheet as required)

Witnesses to accident

Signature of Preparer

Signature of Site Leader

APPENDIX F

TRAFFIC CONTROL

Utility Work Zone Traffic Control Field Guide Book

nationalgrid
The power of action.℠

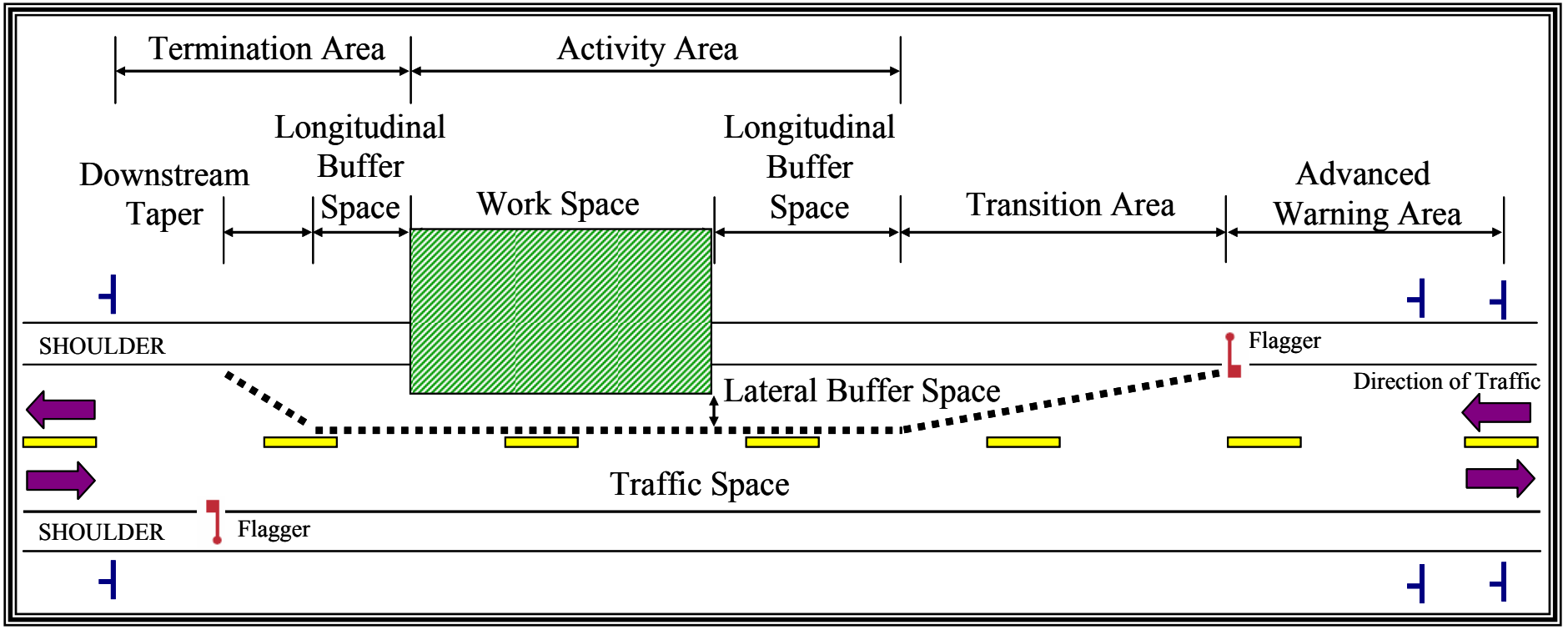
June 2009

- The Work Zone Traffic Control Plans in this guidebook meet the minimum requirements of the federal Manual of Uniform Traffic Control and Devices (MUTCD).

- State and local requirements must be considered when developing specific Work Zone Traffic Control Plans.

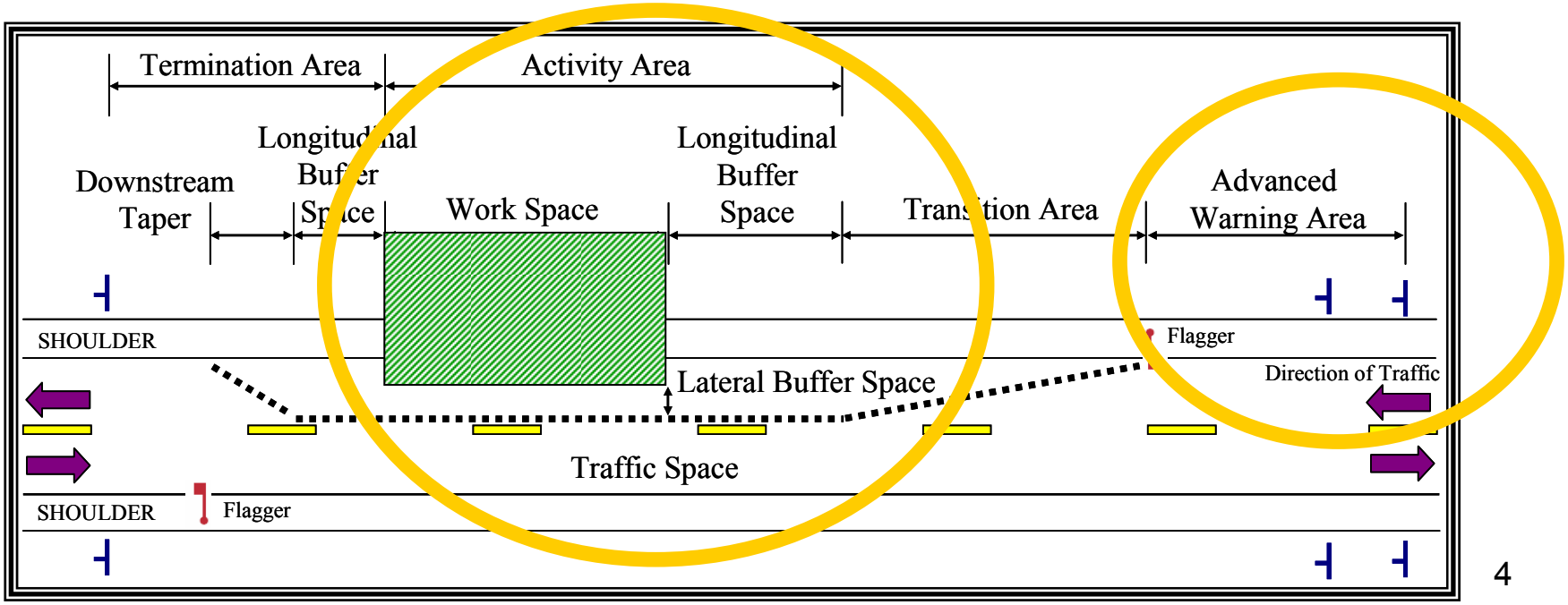
- The Work Zone Traffic Control Plans were developed for the United States Department of Transportation, Federal Highway Administration through a grant to Wayne State University and Bradley University. (August 2008)

Utility Work Zone Temporary Traffic Control Components



Temporary Traffic Control Components

- Activity Area **– work space, traffic space, and buffer space.**
- Advanced Warning Area **– used to provide warning to motorists of an upcoming utility activity.**

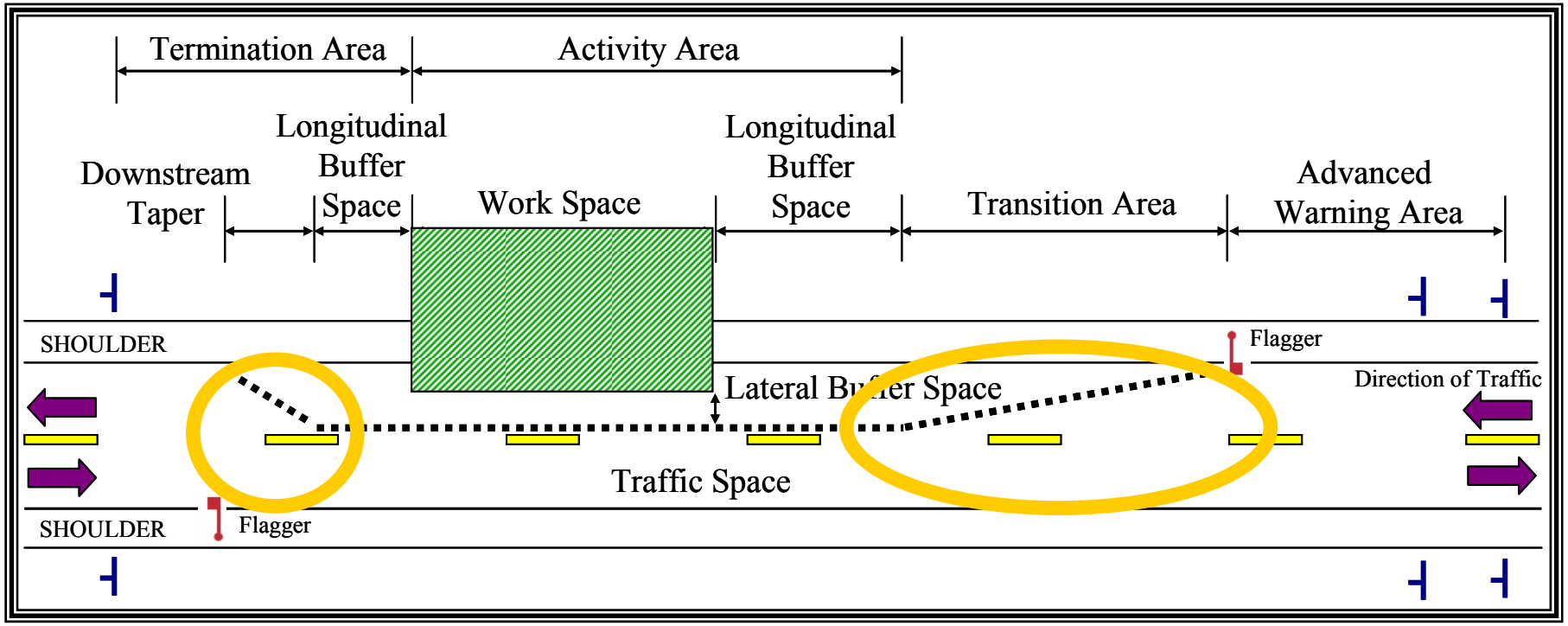


Distance Between Traffic Signs

Road Type	A (Distance Between Signs)
Urban (Low speed)< 45mph	30 m (100 ft)
Urban (High speed) ≥ 45 mph	100 m (350 ft)
Rural	150 m (500 ft)

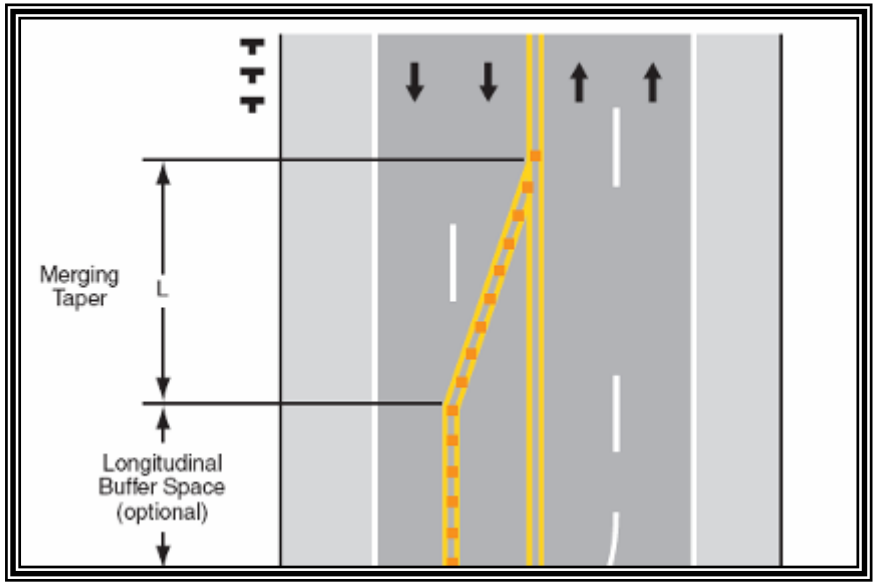
Temporary Traffic Control Components

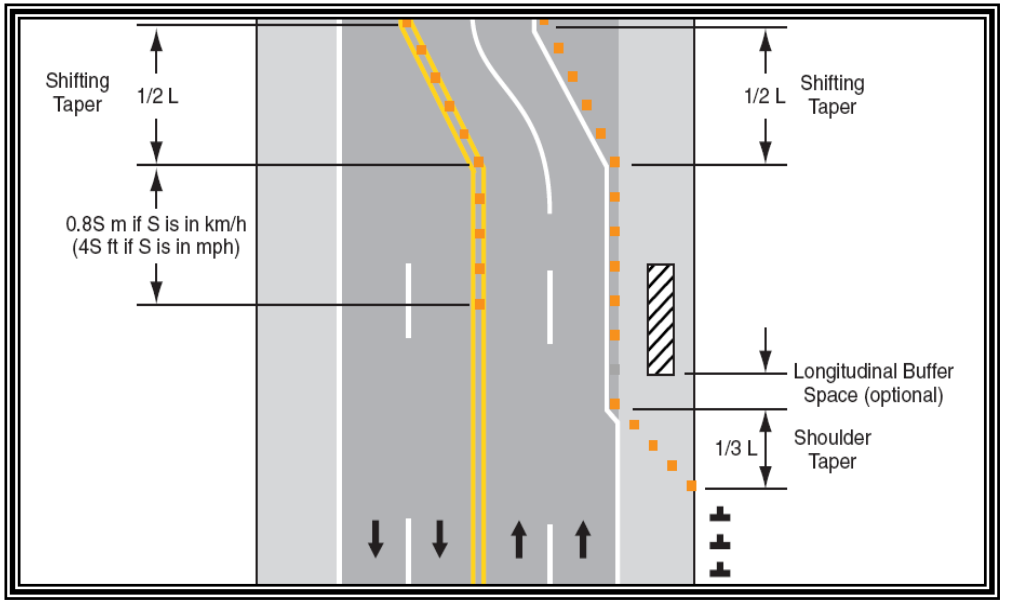
- Tapers – **gradual transition to direct traffic from normal paths to designated path, must be free of workers, vehicles, equipment, etc.**



Different Types of Tapers

Type of Taper	Taper Length (L)*
Merging Taper	at least L
Shifting Taper	at least 0.5L
Shoulder Taper	at least 0.33L
One-Lane, Two-Way Traffic Taper	30 m (100 ft) maximum
Downstream Taper	30 m (100 ft) per lane





Source: MUTCD Figure 6C-2 and Table 6C-3

Formulas for Calculating Taper Lengths

Speed Limit (S)	Taper Length (L) Meters
60 km/h or less	$L = \frac{WS^2}{155}$
70 km/h or more	$L = \frac{WS}{1.6}$

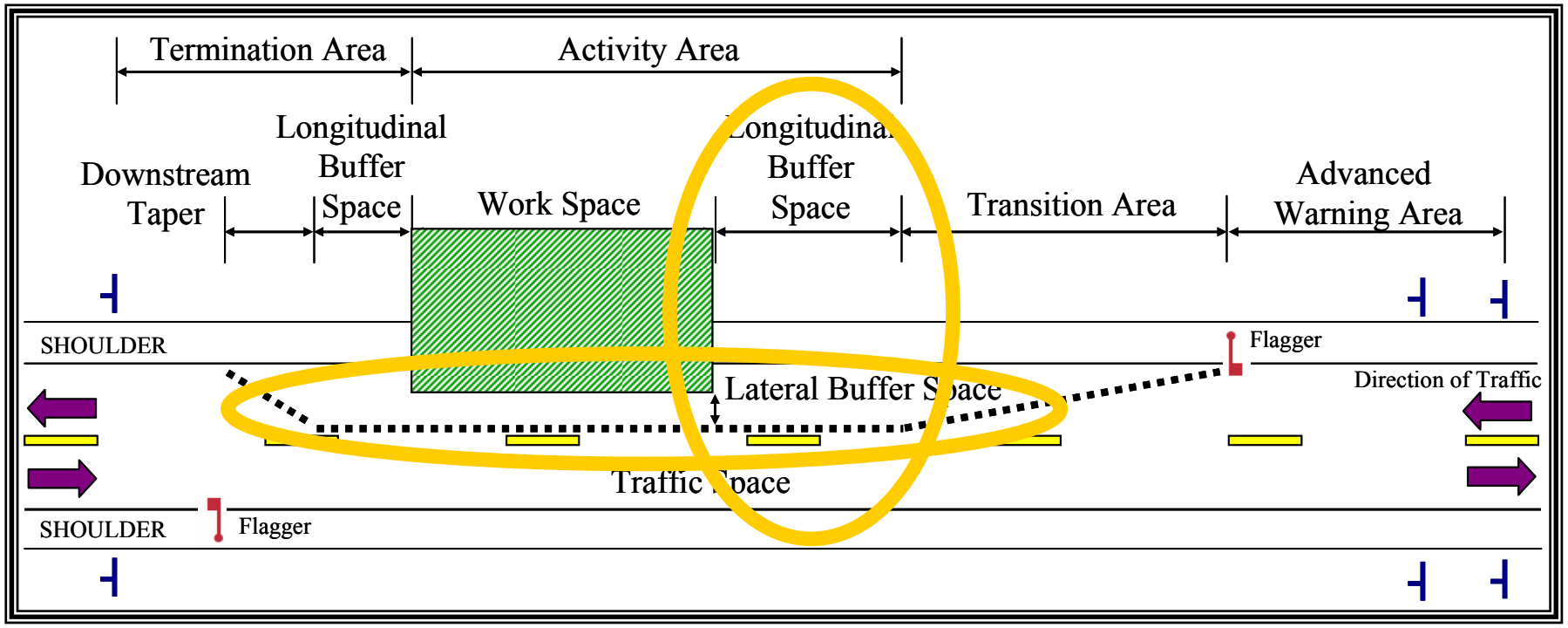
Speed Limit (S)	Taper Length (L) Feet
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	L = WS

Where: L = taper length in meters (feet)
W = width of offset in meters (feet)
S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in km/h (mph)

Source: MUTCD Table 6C-4

Temporary Traffic Control Components

- Buffer Space (Optional) **– lateral and/or longitudinal area that separates traffic from work space, must be free of workers, vehicles, equipment, etc.**

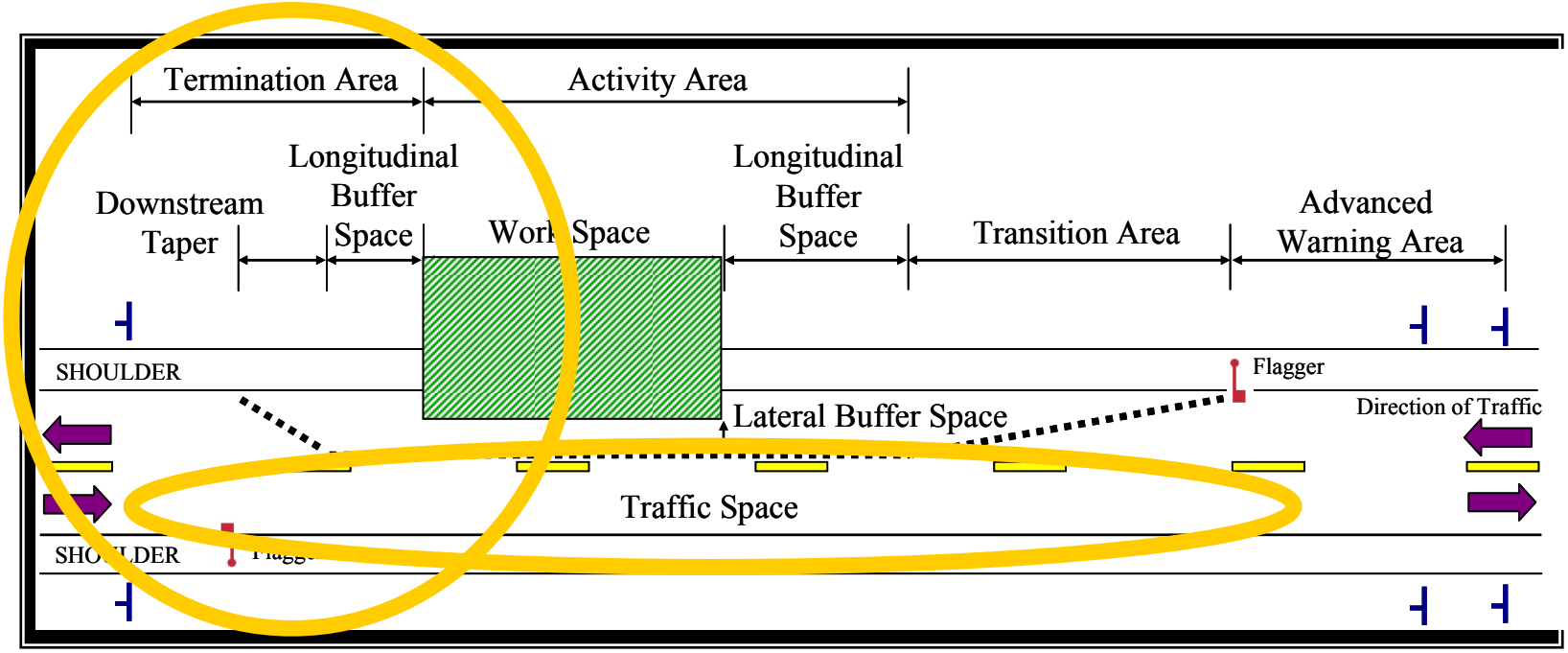


Why Use a Buffer Space?

- Improves worker safety
- Required in some jurisdictions
- May alleviate the need for more complex Traffic Control measures
- Provides additional space between work zone and motorists
- Easy to accommodate into Work Zone plan

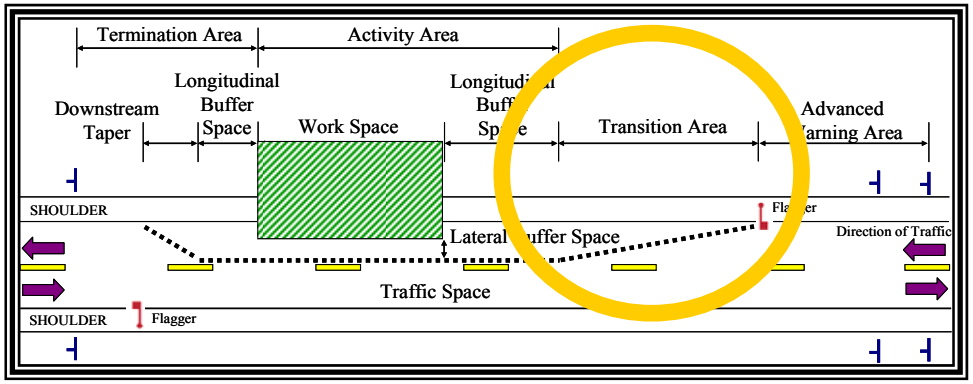
Temporary Traffic Control Components

- Termination Area – **area used to return to normal path**
- Traffic Space – **portion of highway in which road users are routed through the activity area**

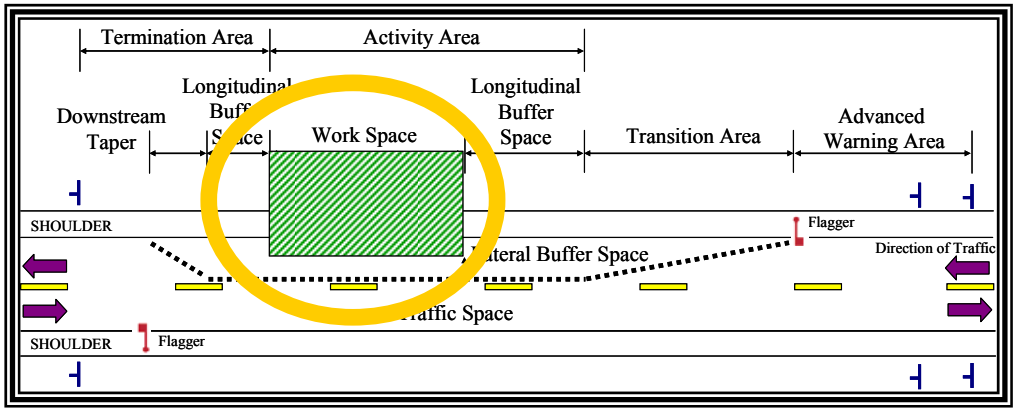


Temporary Traffic Control Components

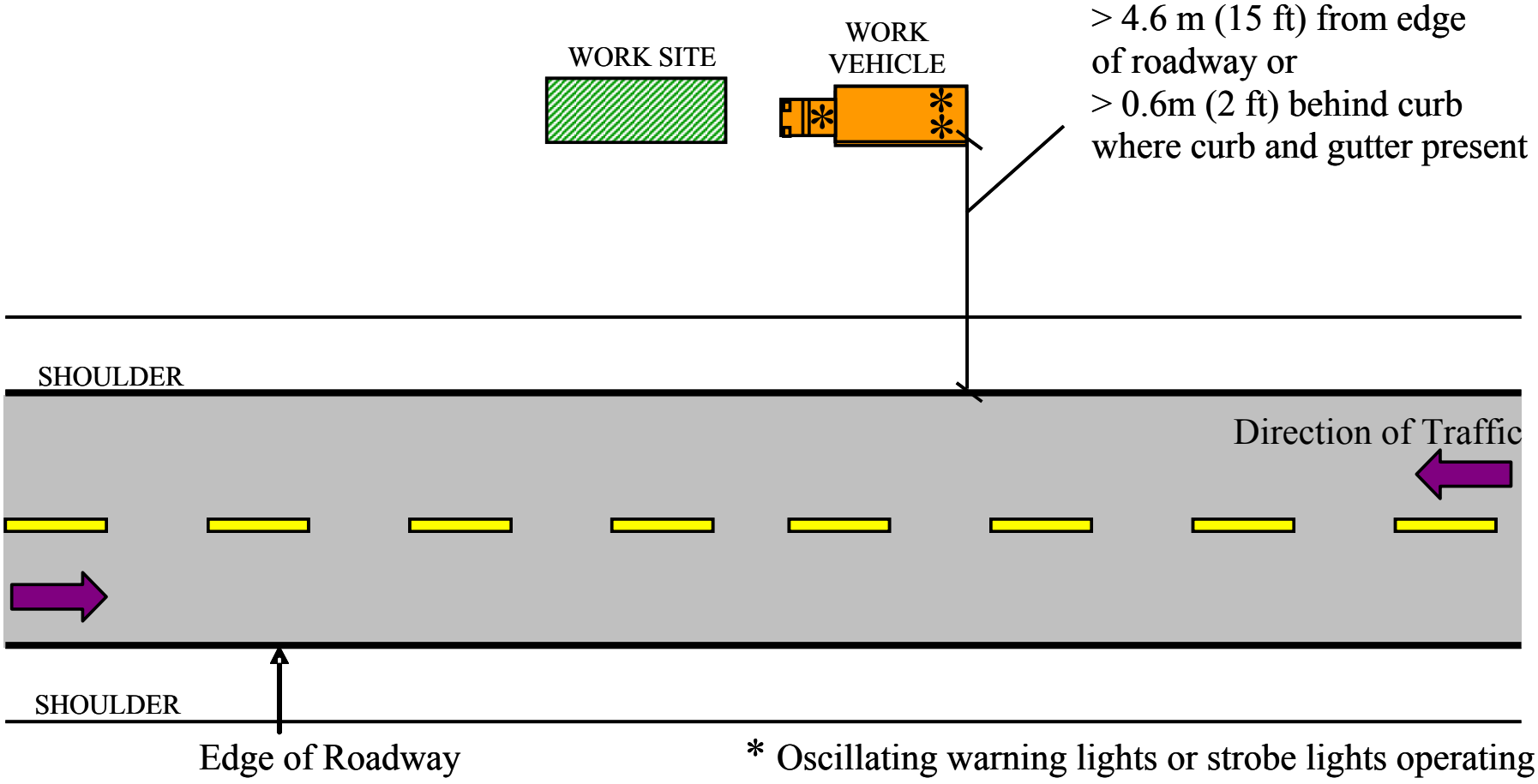
- Transition Area – **area utilized to move motorists from their normal path**



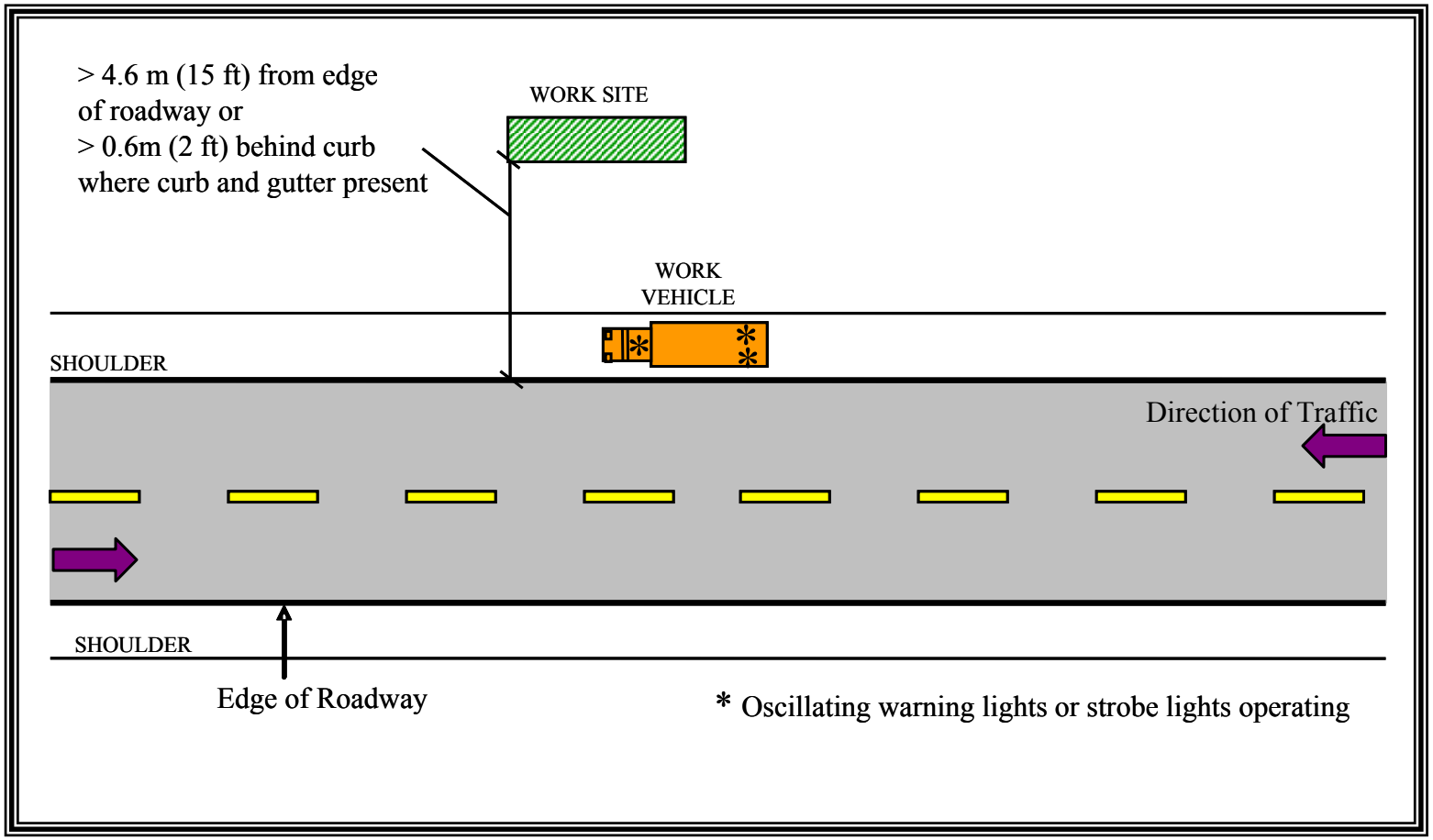
- Work Space – **portion closed to road users – occupied by utility workers, equipment and vehicles.**



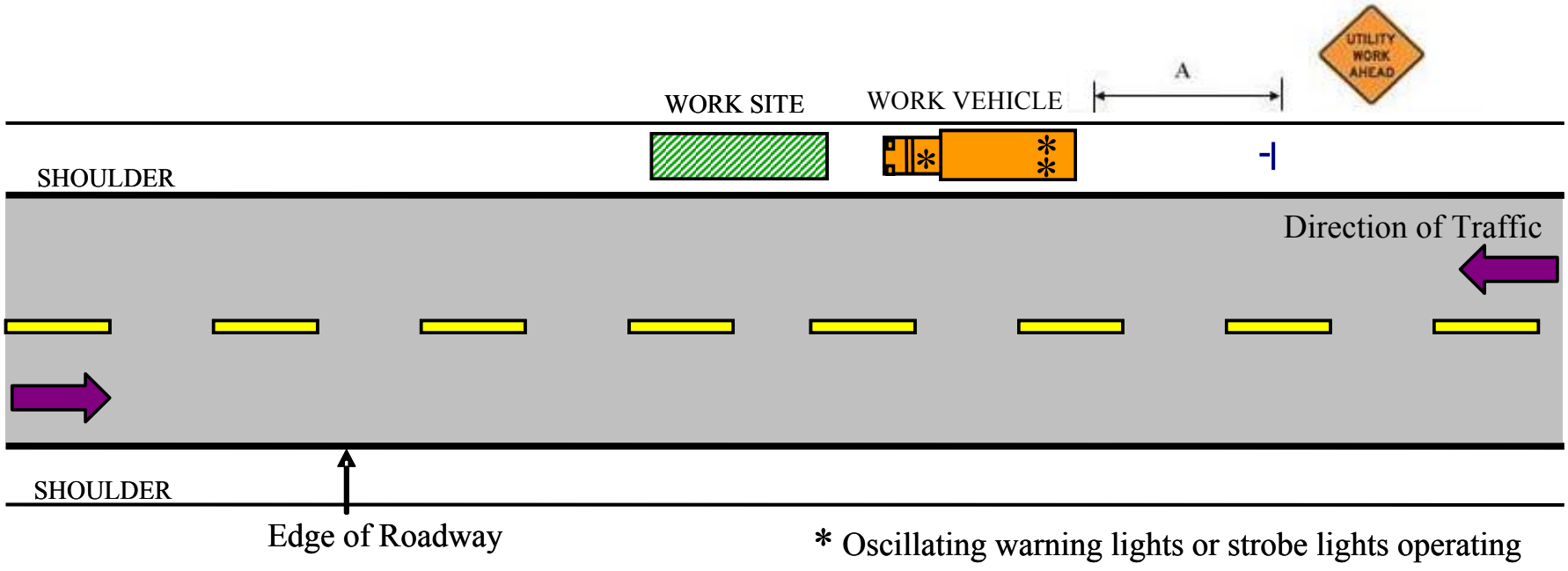
Utility Work Beyond Shoulder



Utility Work Beyond Shoulder with Work Vehicle(s) Parked on Shoulder



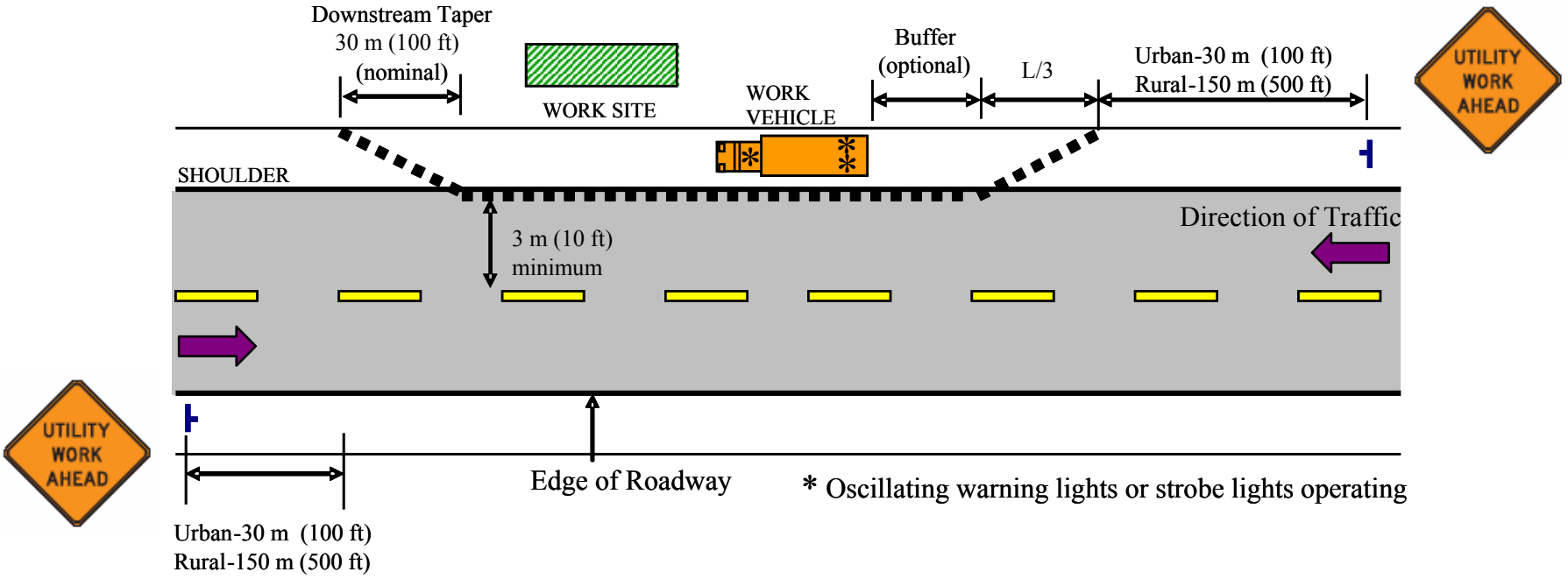
Utility Work on Shoulder
(Low Traffic Volume and Low Speed)



TCP-C

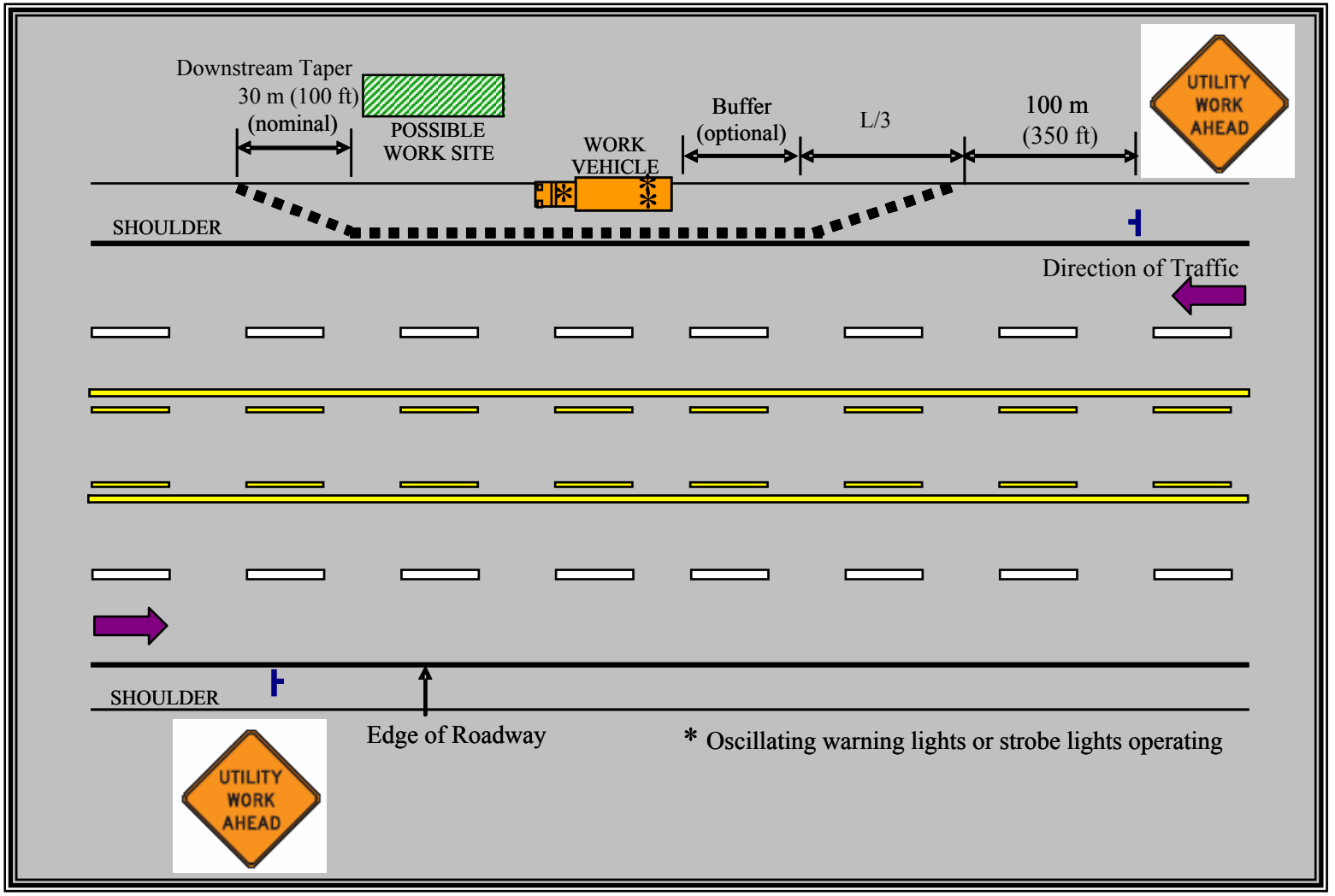
Utility Work Beyond Shoulder with Work Vehicle Parked on Shoulder

(High Traffic Volume and/or High Speed)



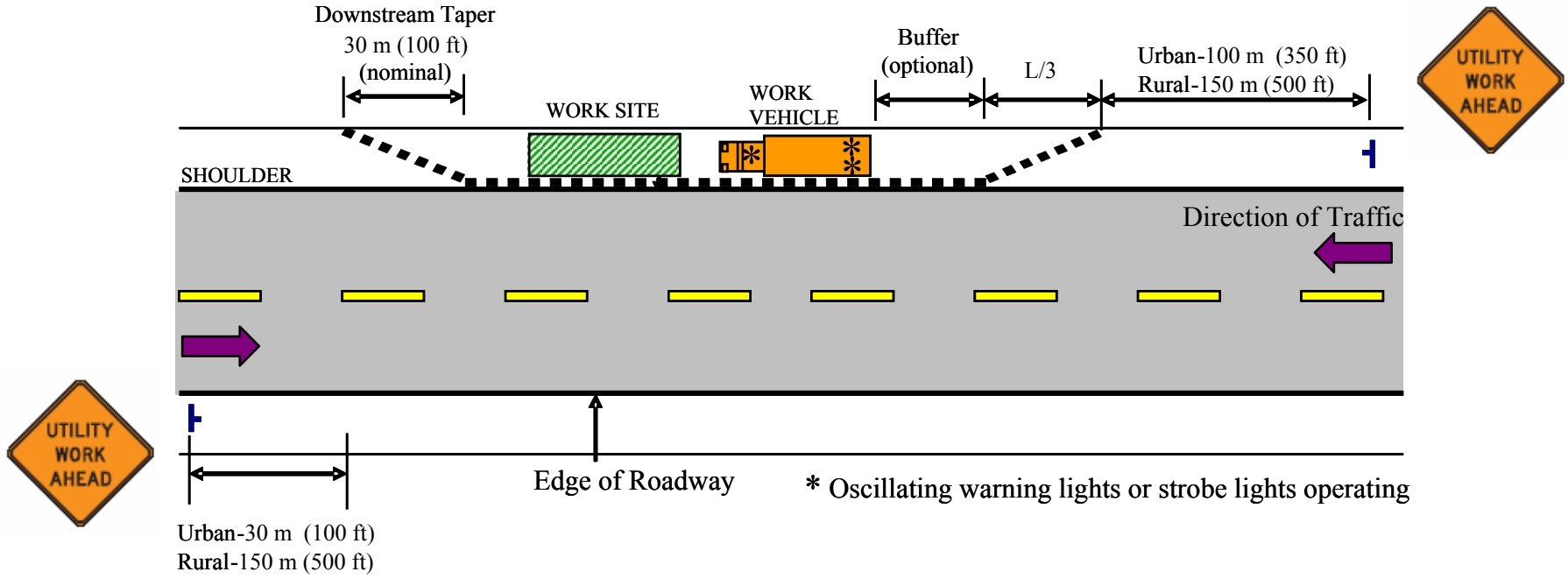
Utility Work Beyond Shoulder with Work Vehicle(s) Parked on Shoulder

(High Traffic Volume and/or High Speed)



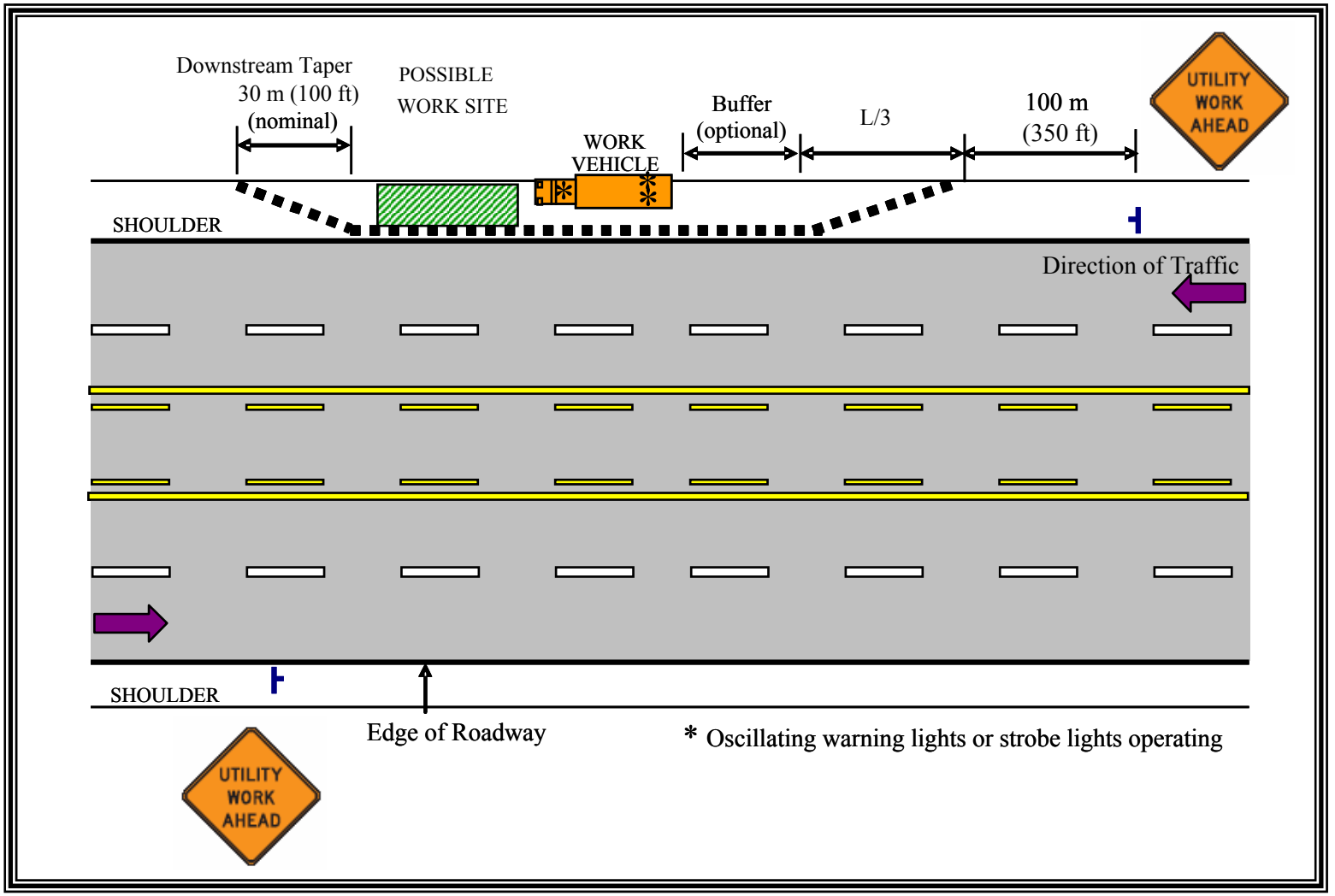
Utility Work on Shoulder with no Encroachment on Roadway

(High Traffic Volume and High Speed)



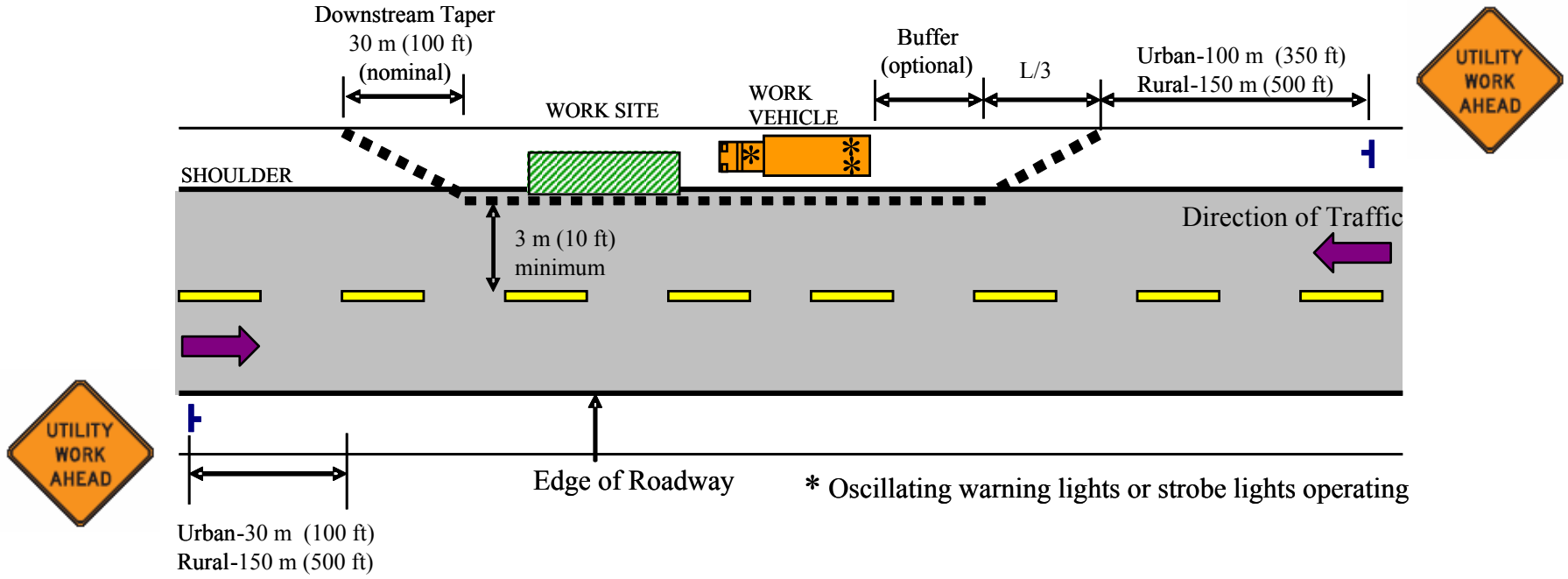
Utility Work on Shoulder with No Encroachment on Roadway

(High Traffic Volume and/or High Speed)



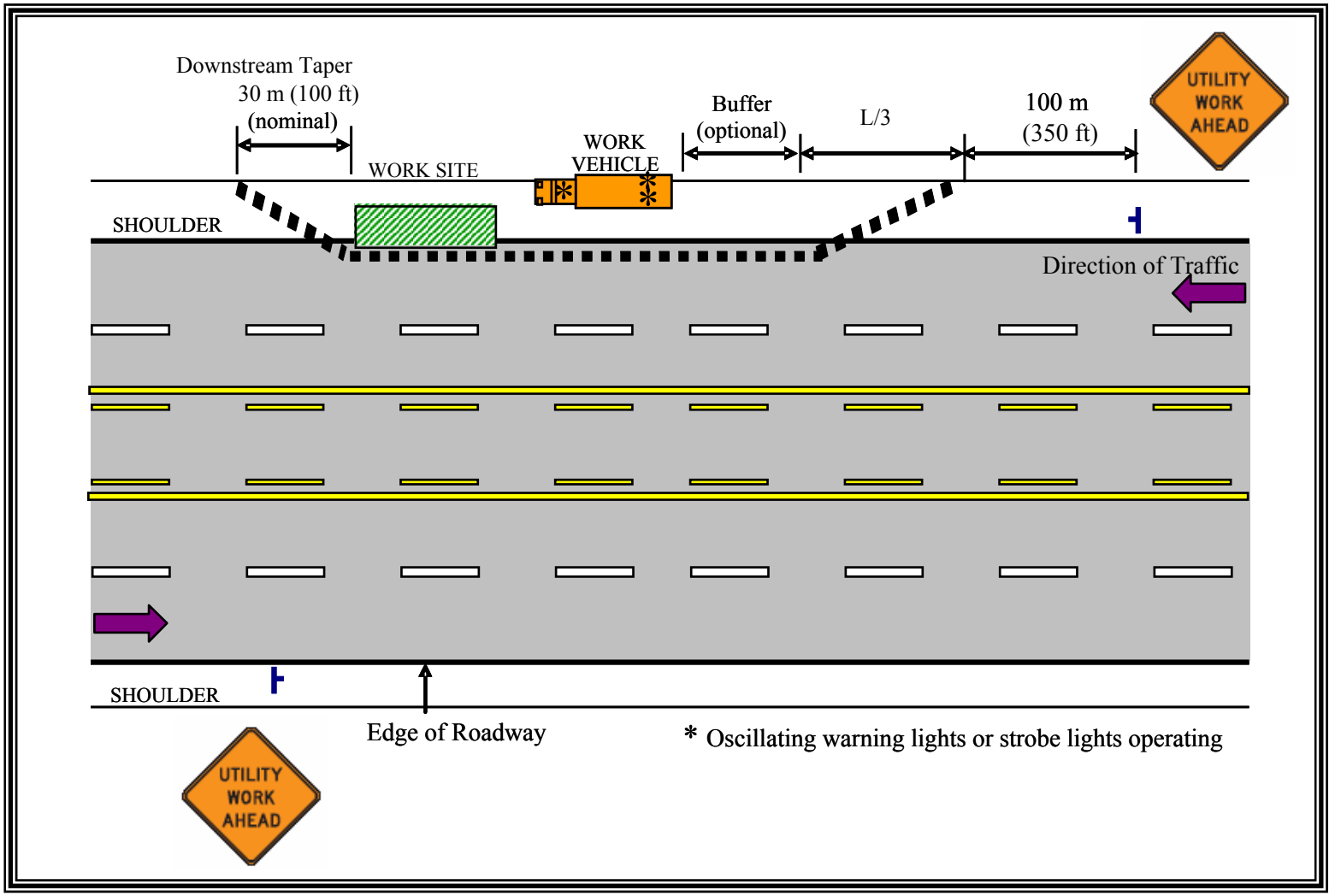
Utility Work on Shoulder with Minor Encroachment

(High Traffic Volume and High Speed)



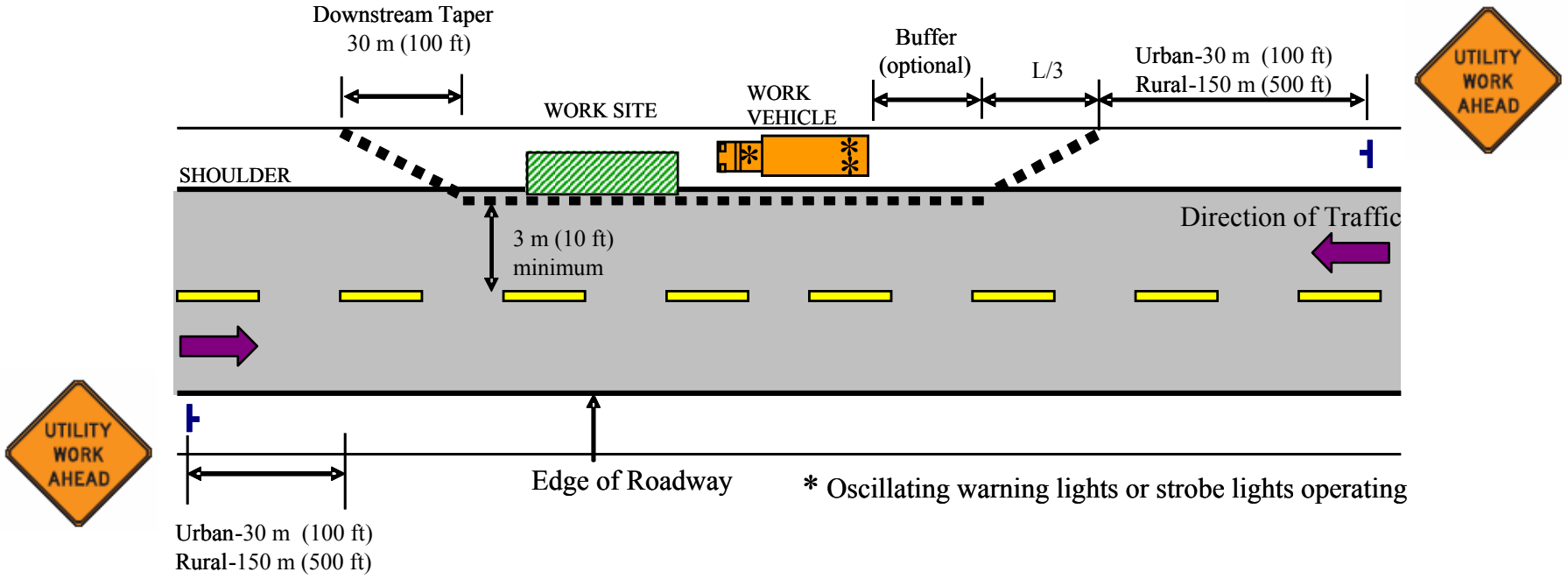
Utility Work on Shoulder with Minor Encroachment on Roadway

(High Traffic Volume and/or High Speed)



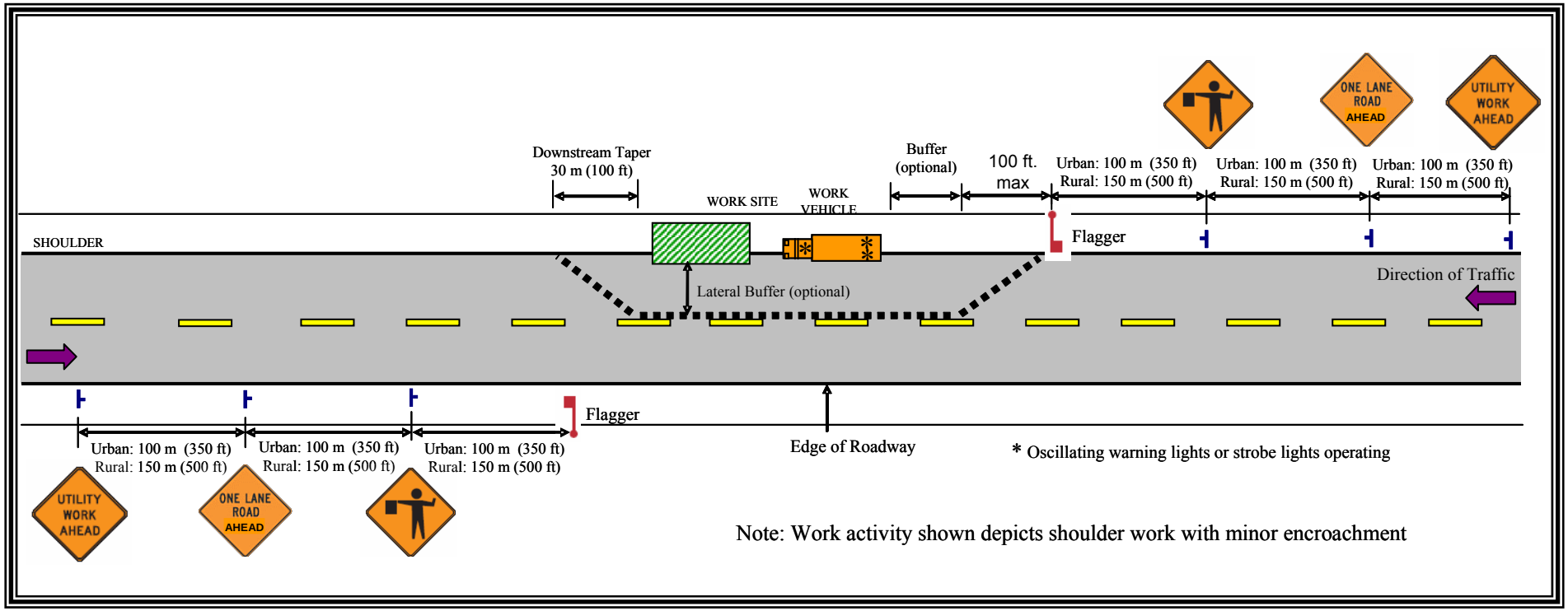
Utility Work on Shoulder with Minor Encroachment

(Low Traffic Volume and Low Speed)

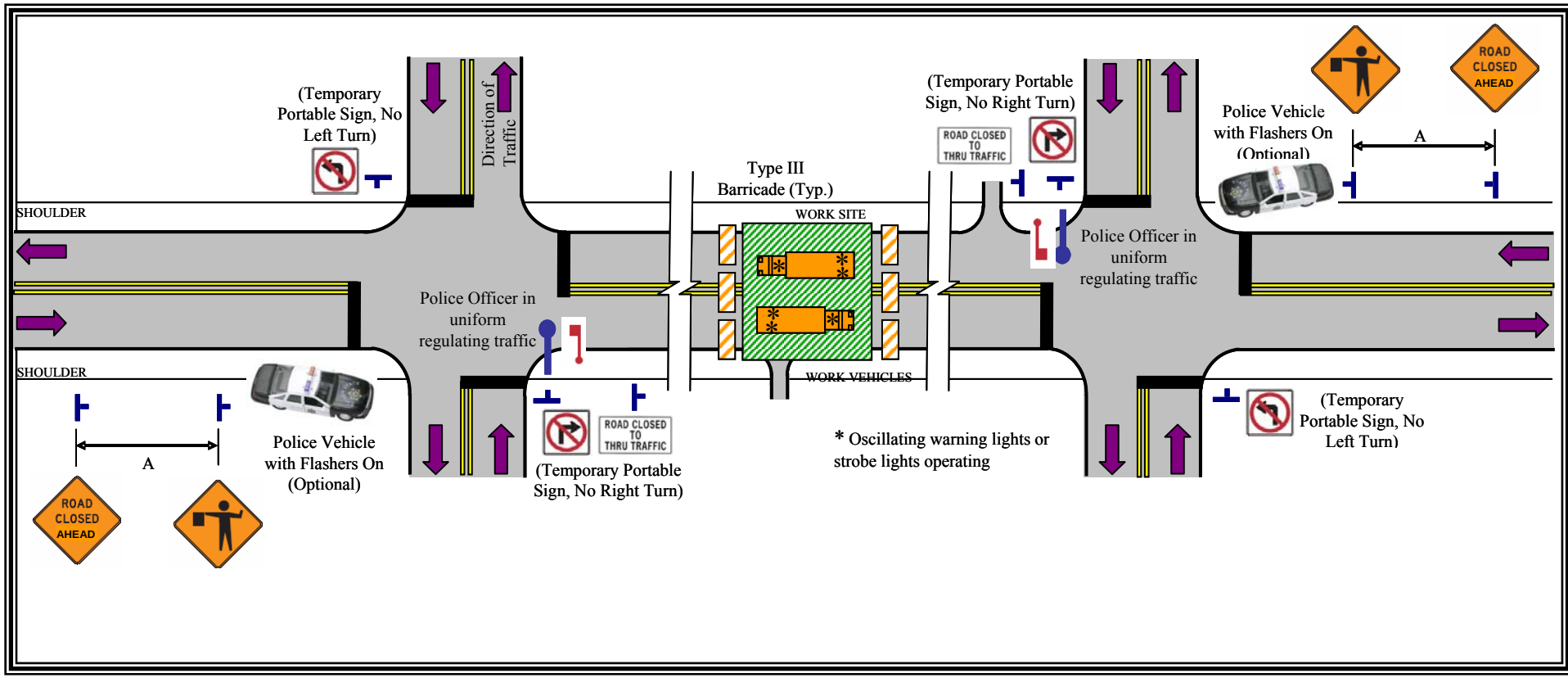


Utility Work on Shoulder with Minor Encroachment or Lane Closure on Two-Lane Road

(High Traffic Volume and/or High Speed)



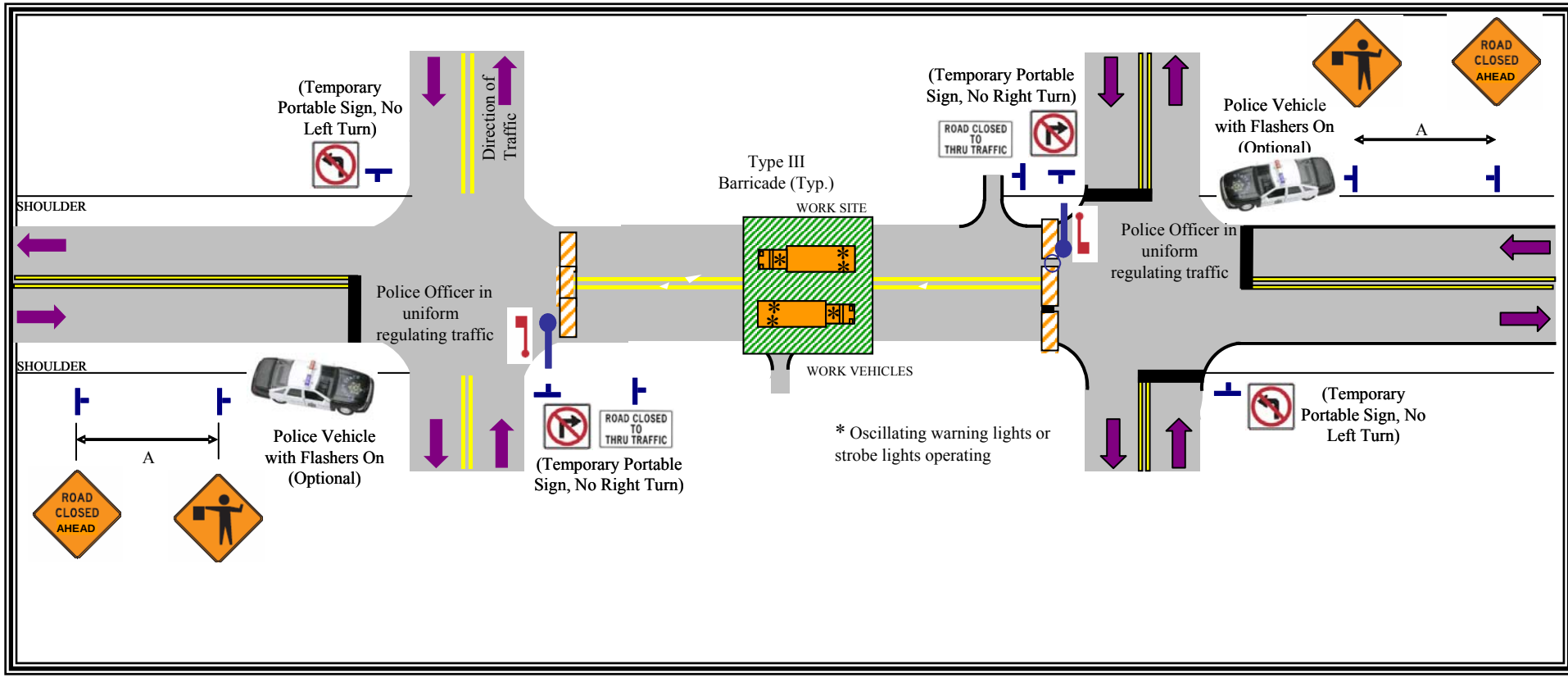
Temporary Road Closure
Mid Block



1. Planned Closure less than 20 minutes – Flagger or Police Vehicle Required
2. More than 20 minutes – Type III Barricades and appropriate traffic control signs shall be used – Use Flaggers where deemed appropriate.
3. White Road Closed Signs may have different wording such as Road Closed, Local Traffic Only

TCP-F

Temporary Road Closure
Full Block Closure



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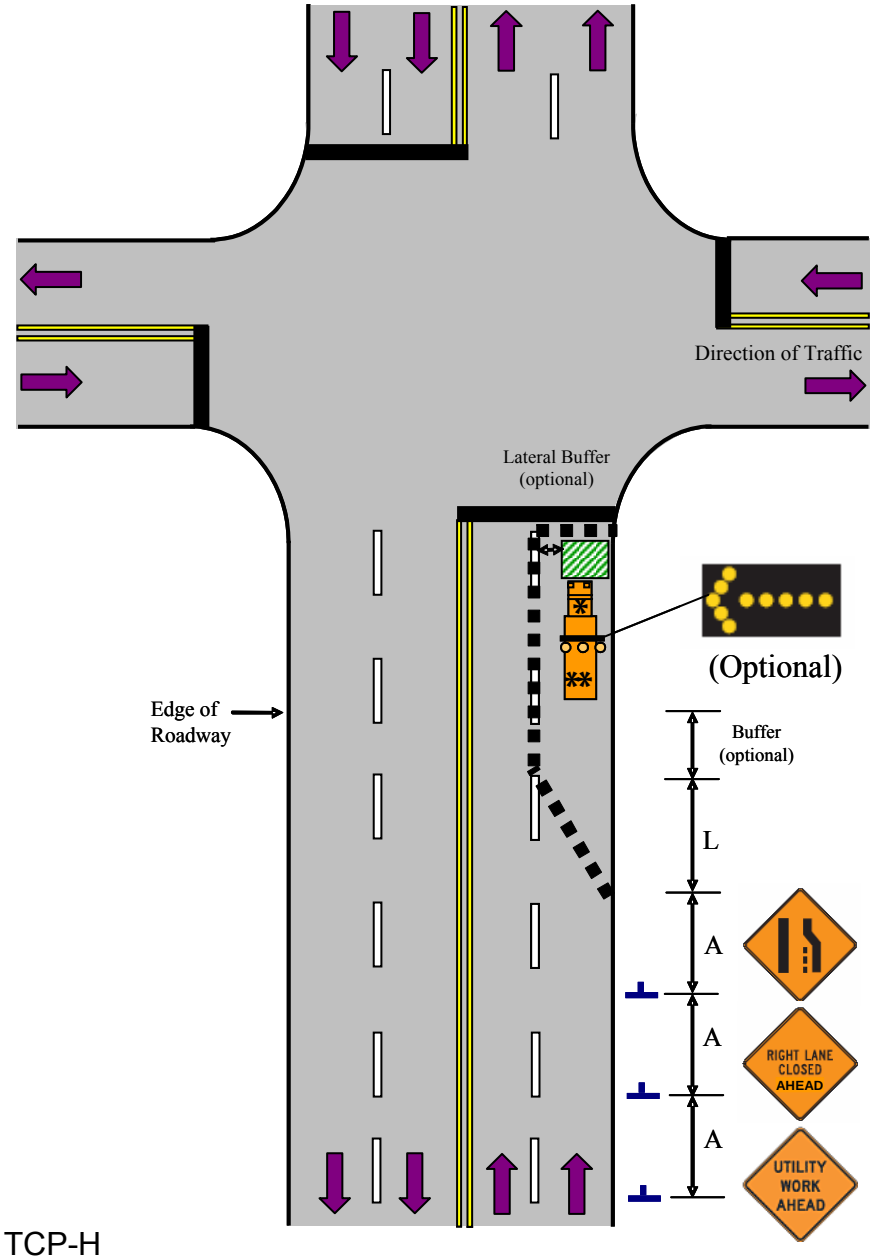
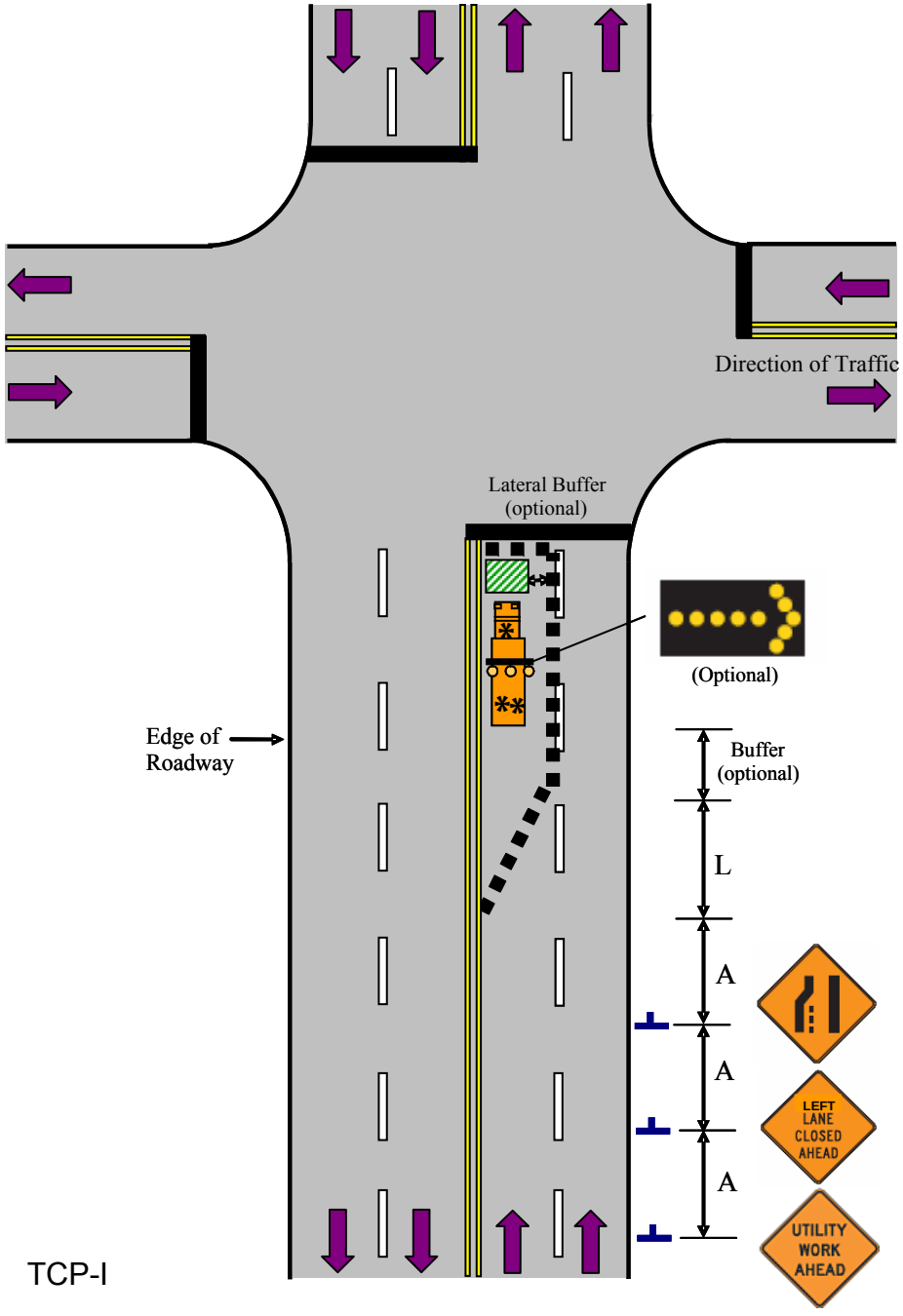
3. White Road Closed Signs may have different wording such as Road Closed, Local Traffic Only

Right Lane Closure on Near Side of Intersection

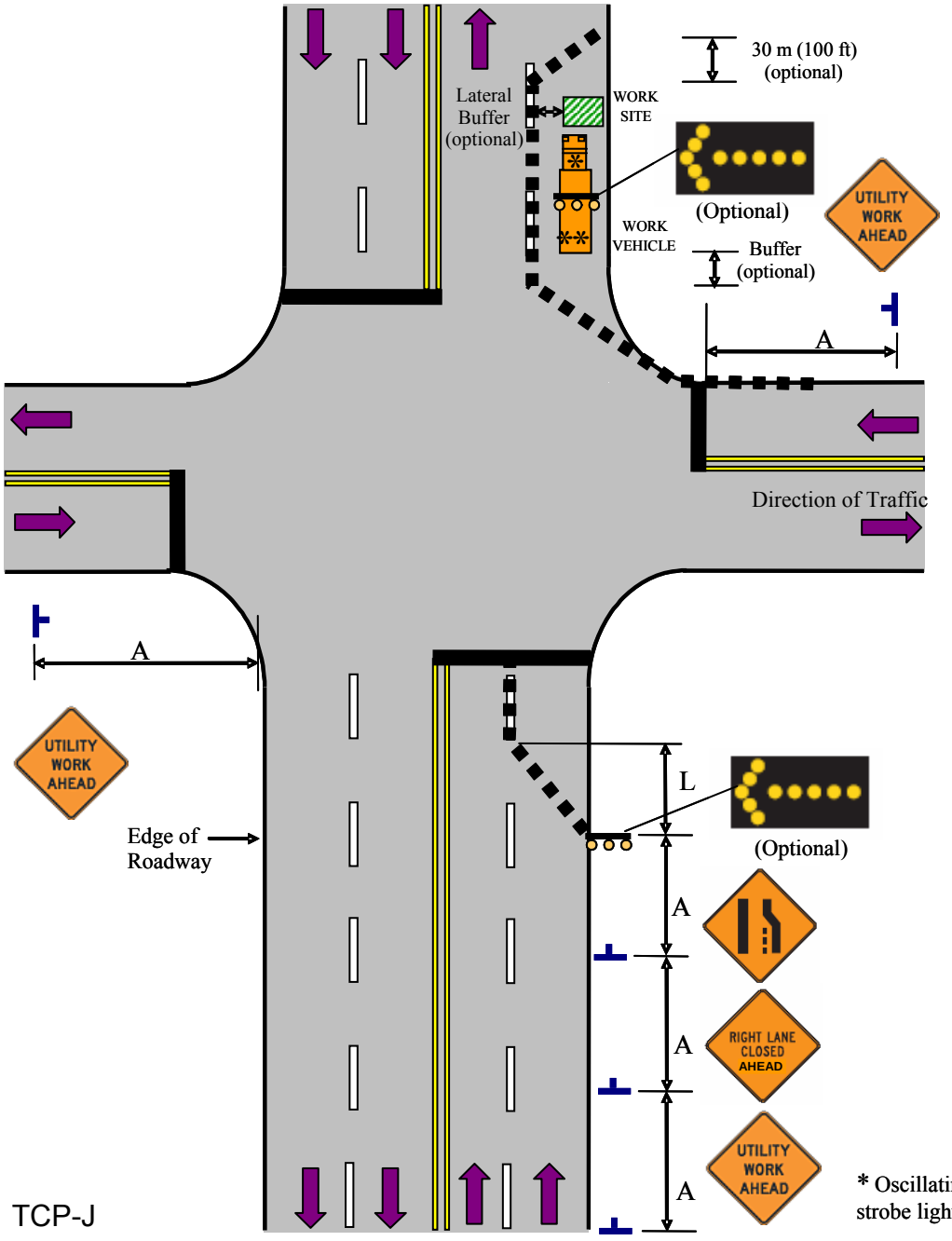


TCP-H

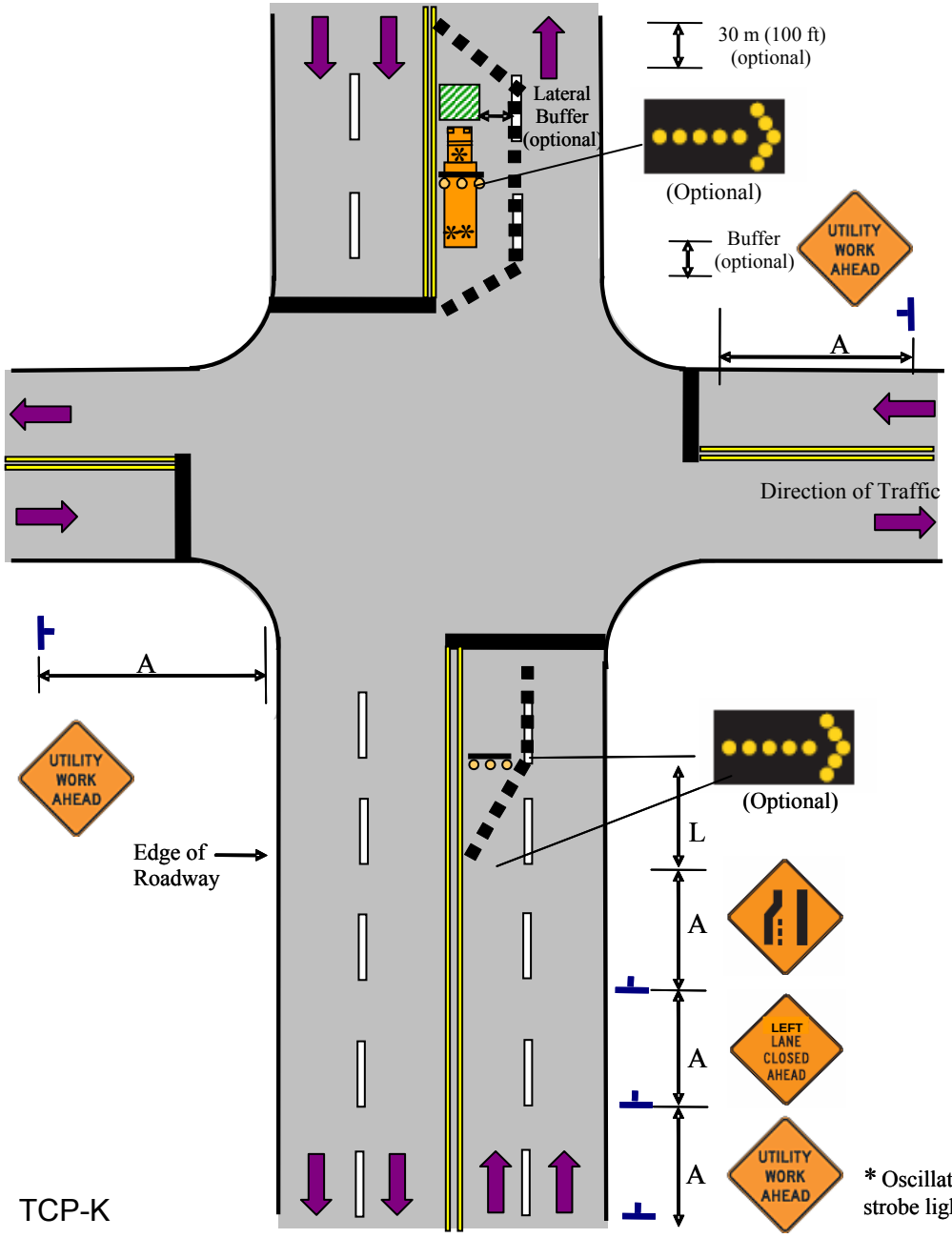
Left Lane Closure on Near Side of Intersection



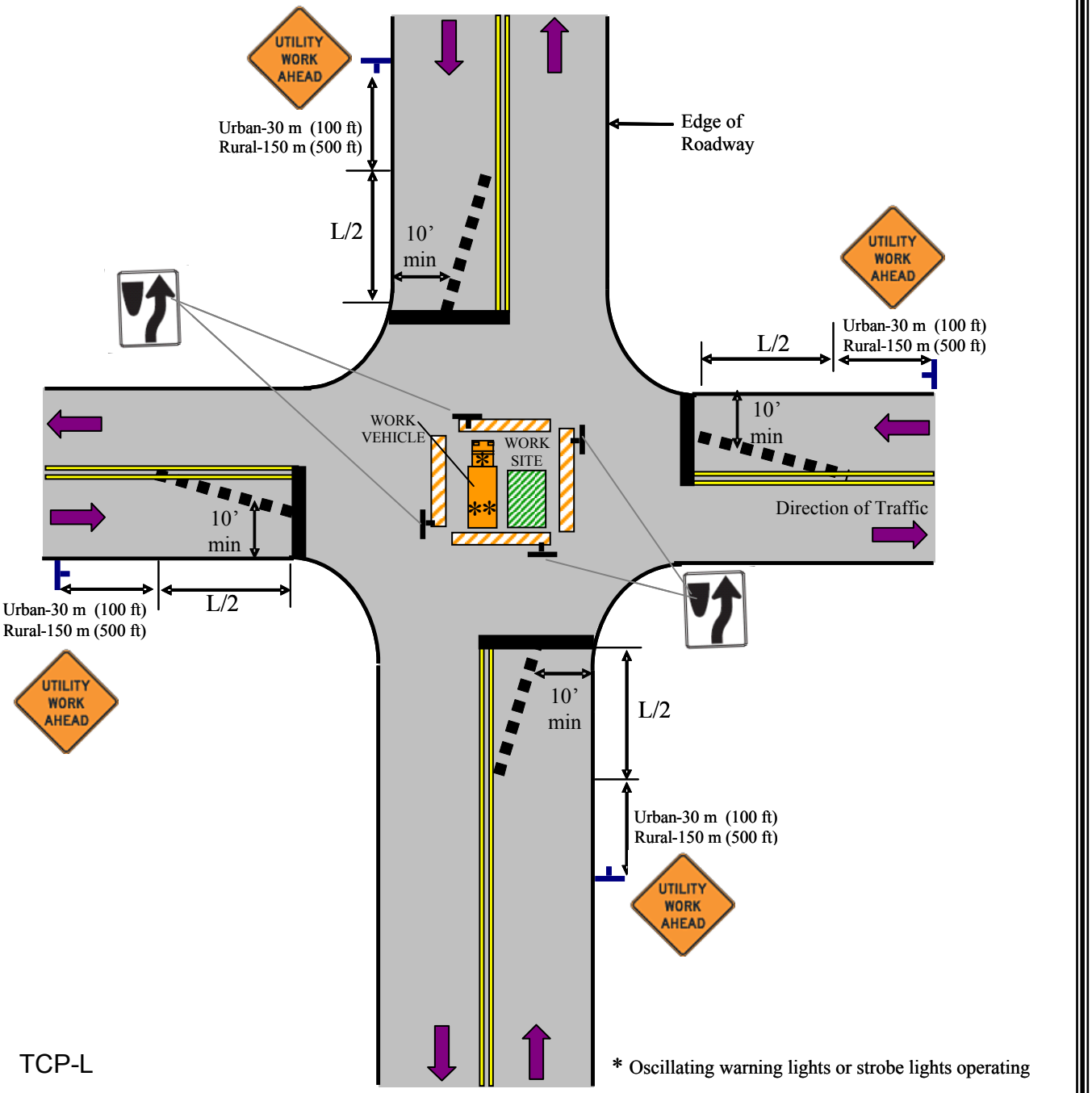
TCP-I



Right Lane Closure on Far Side of Intersection

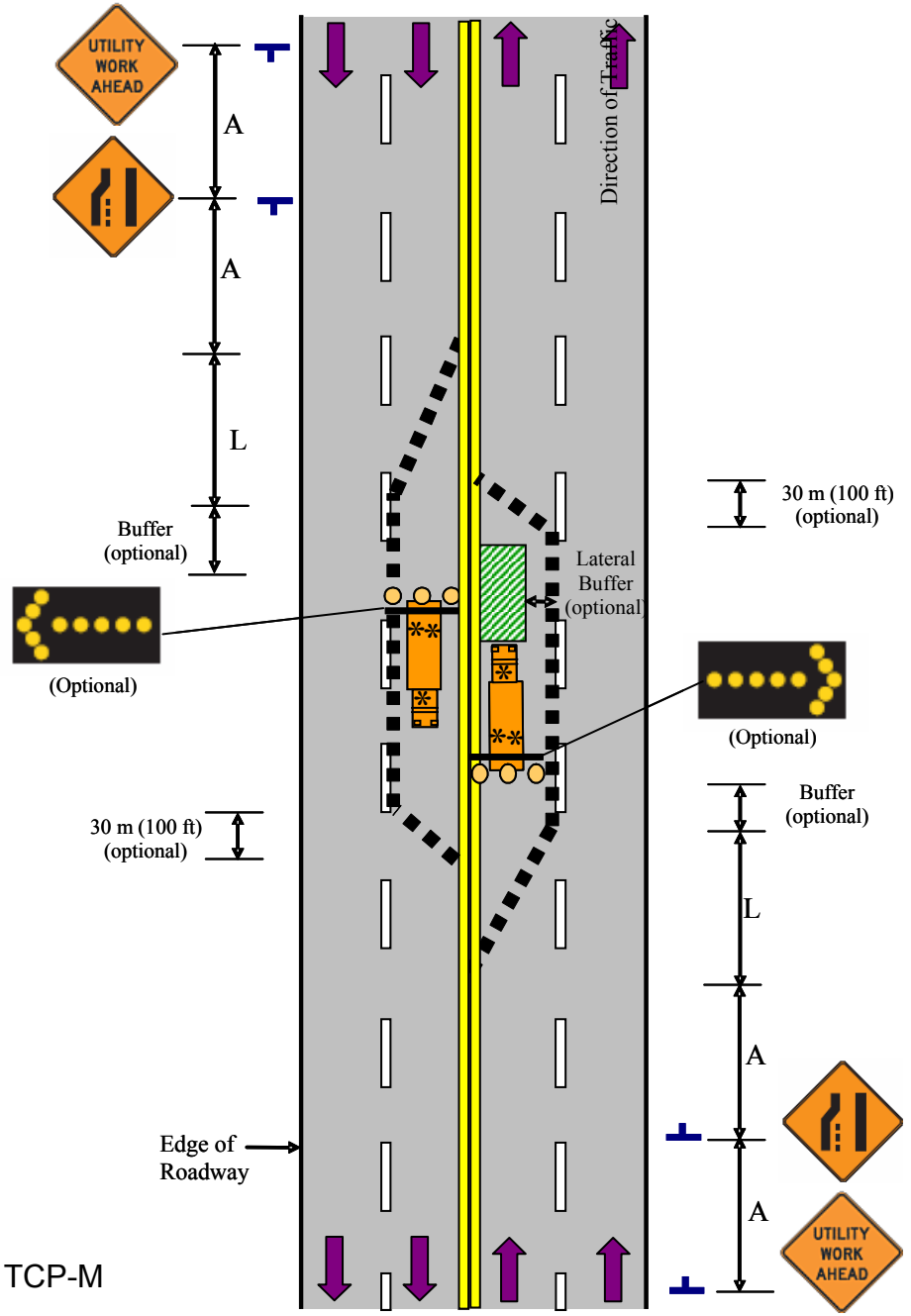


Left Lane Closure on Far Side of Intersection



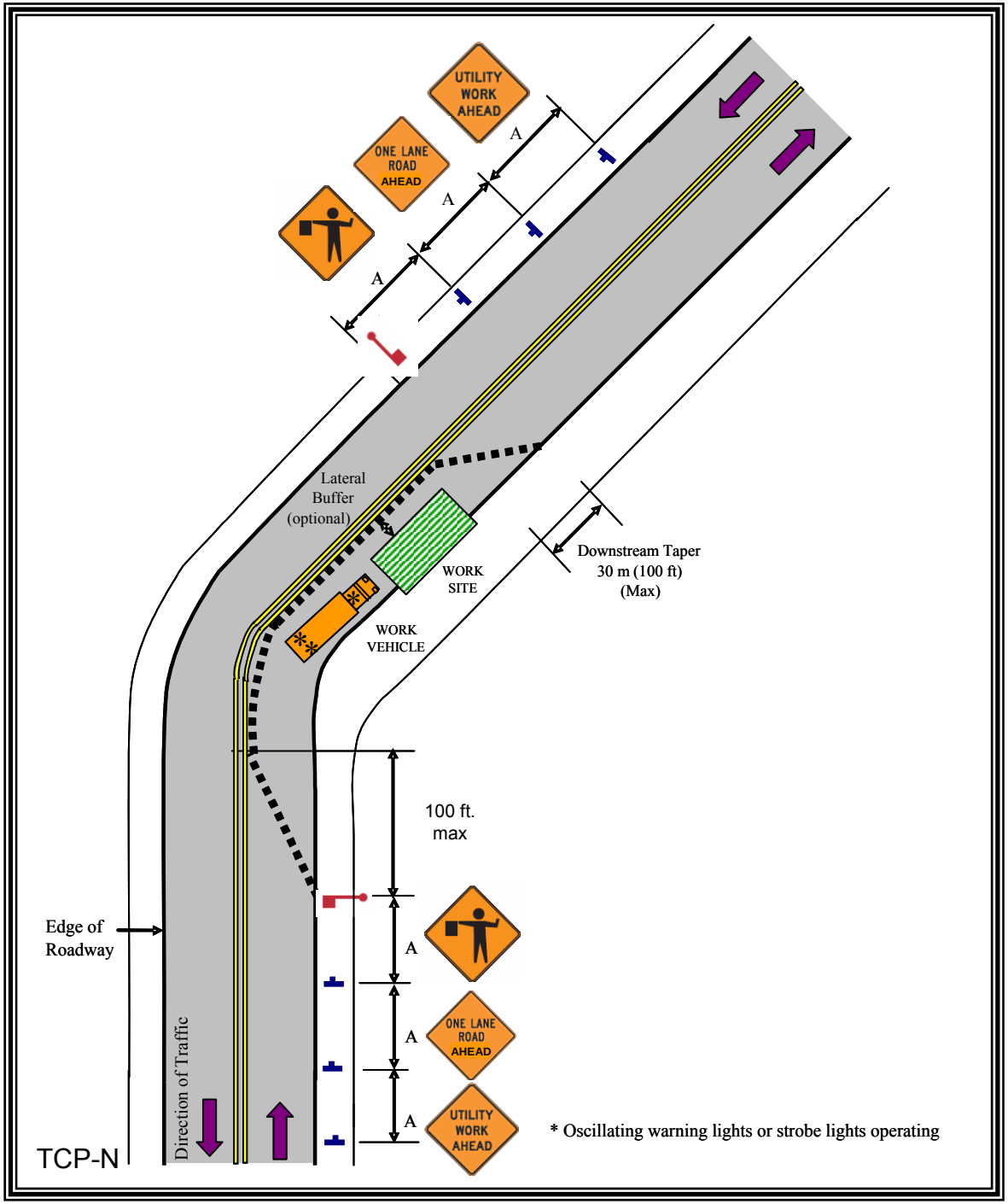
Closure in Center of Intersection

Center Lane Closure on a Multi-Lane Road

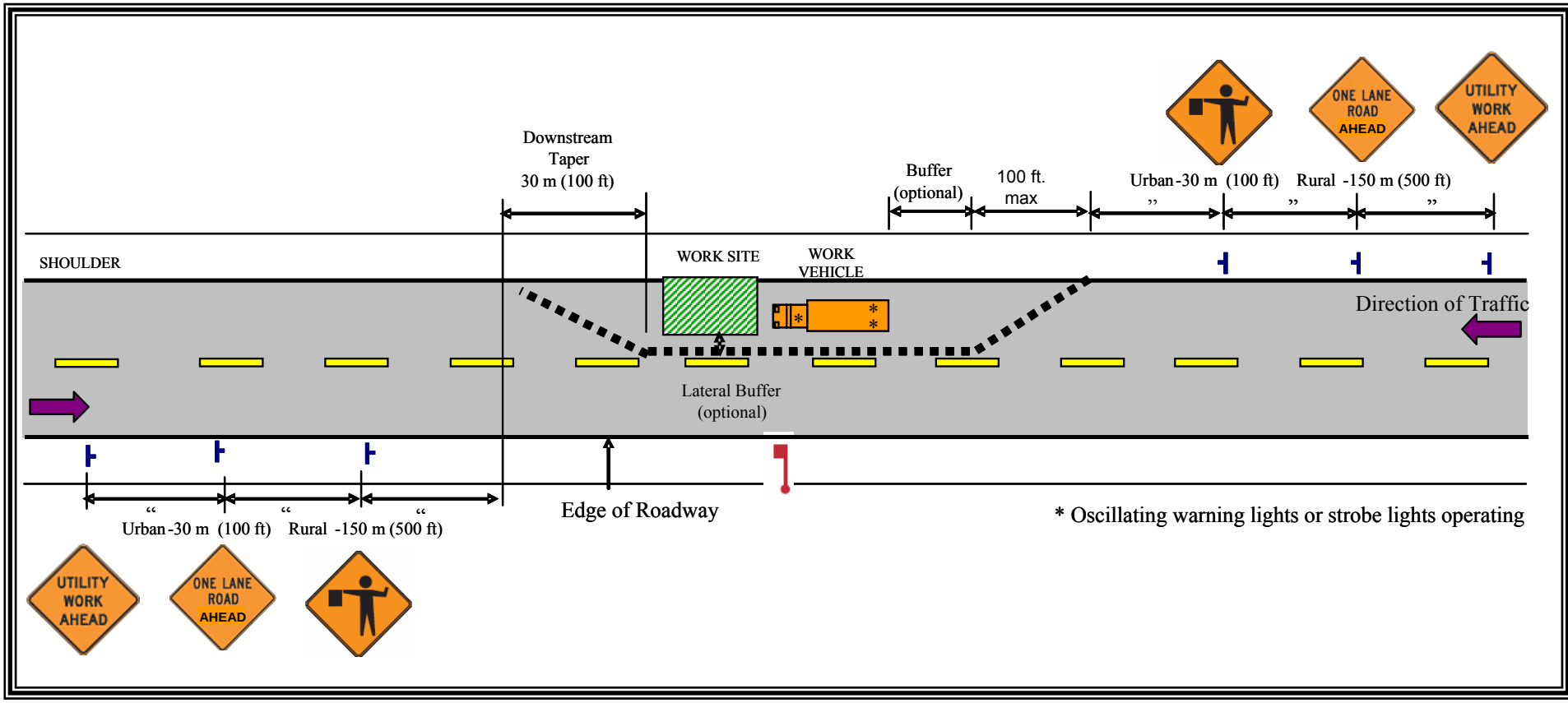


TCP-M

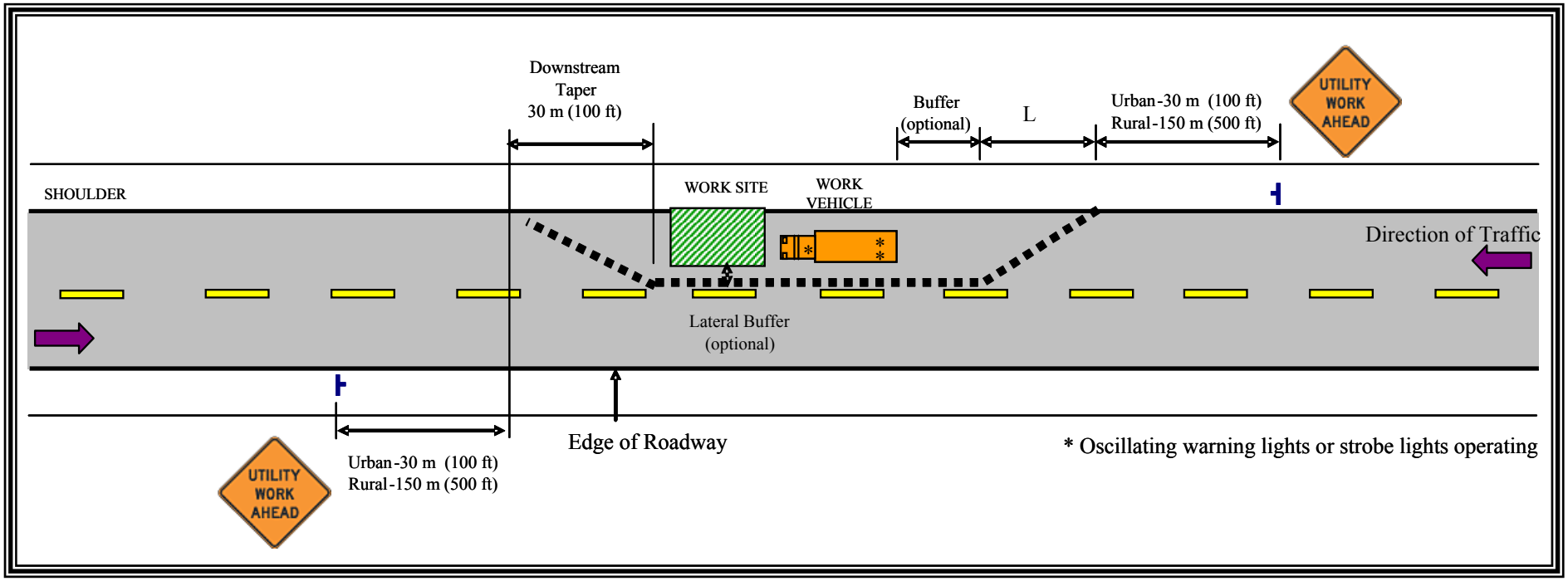
Lane Closure On Two-Lane Road (Restricted Visibility)



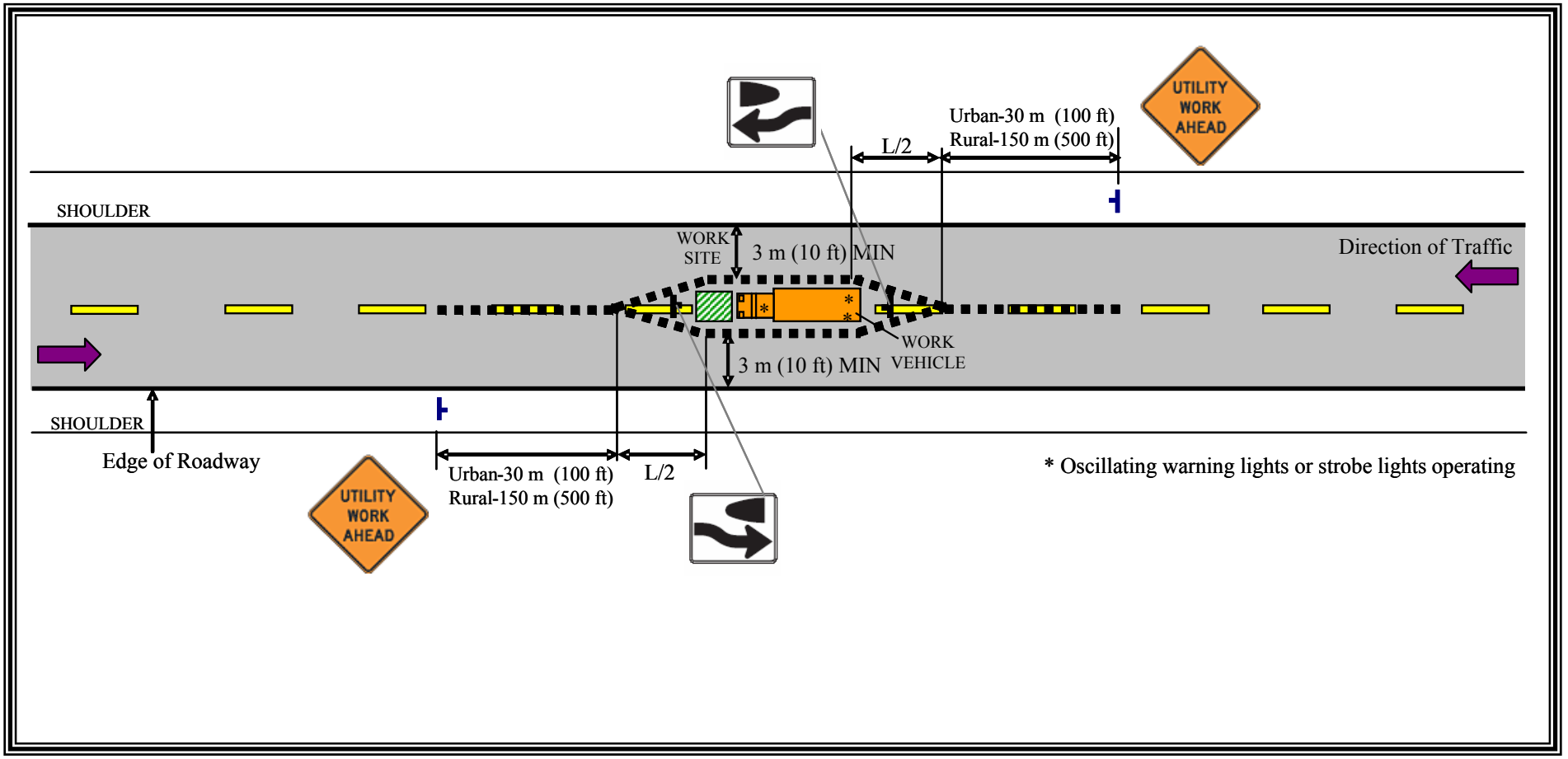
Lane Closure on Two-Lane Road with Unrestricted Visibility
(Low Traffic Volume, Low Speed where Traffic cannot self-regulate without the use of Flaggers)



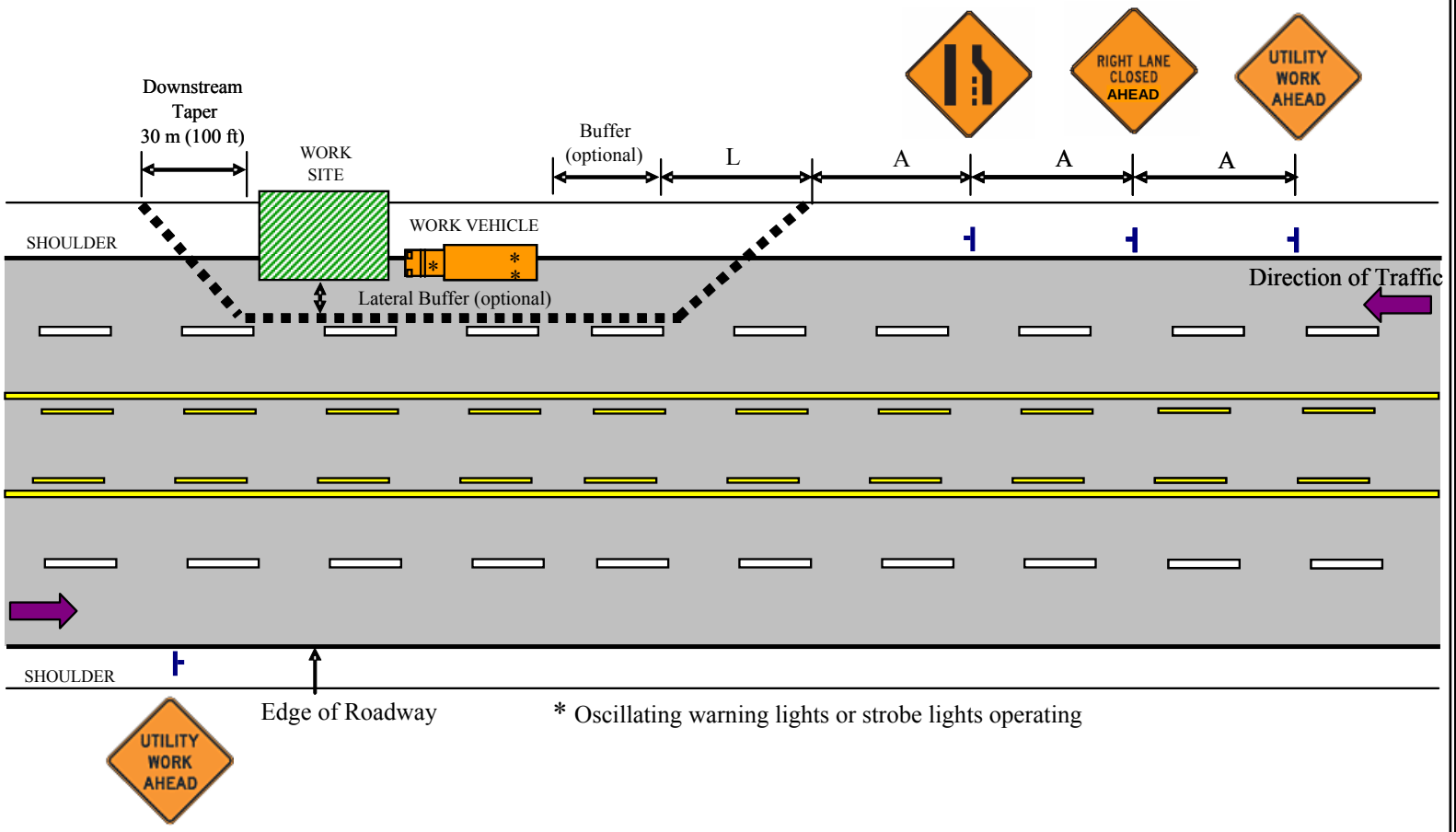
Lane Closure on Two-Lane Road with Unrestricted Visibility
(Low Traffic Volume, Low Speed where Traffic can self-regulate without the use of Flaggers)



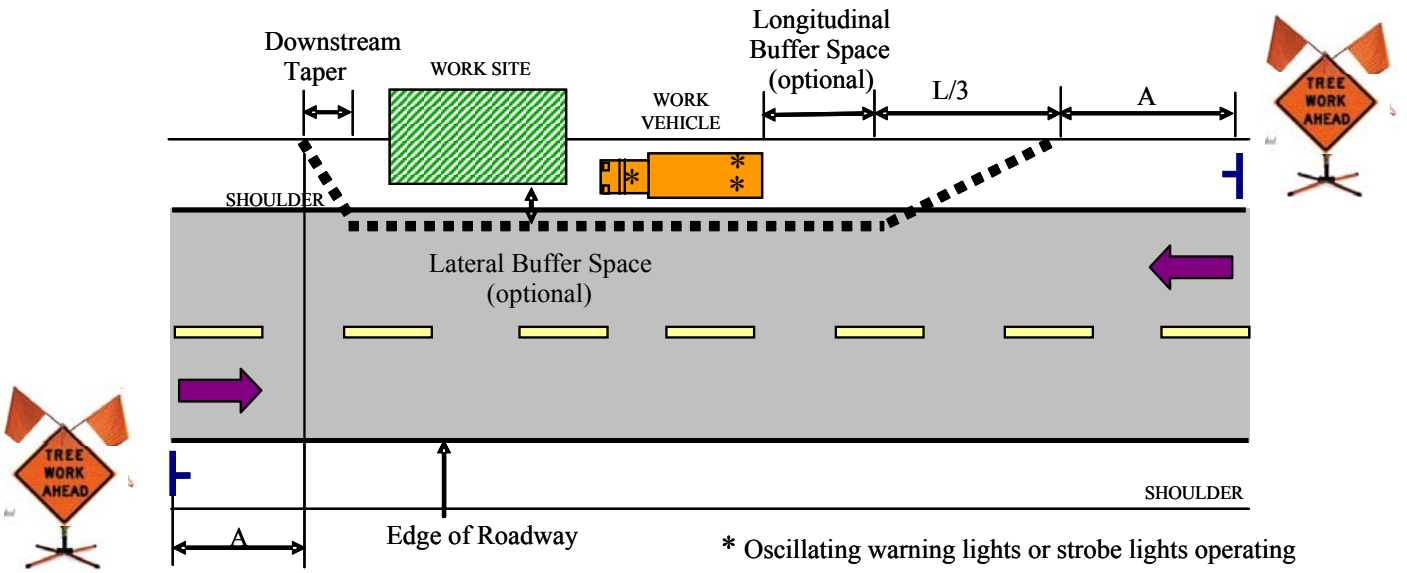
Utility Work in Center of Road
(Low Traffic Volumes)



Outside Lane Closure on Multi-Lane Road

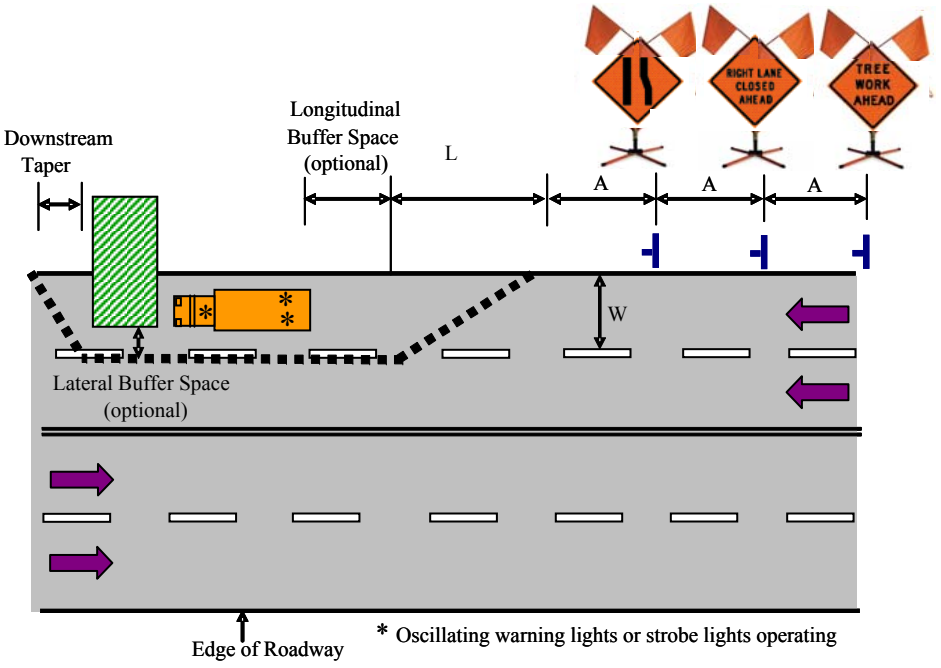


Tree Cutting/Trimming Shoulder Closure on a Two-Lane Road



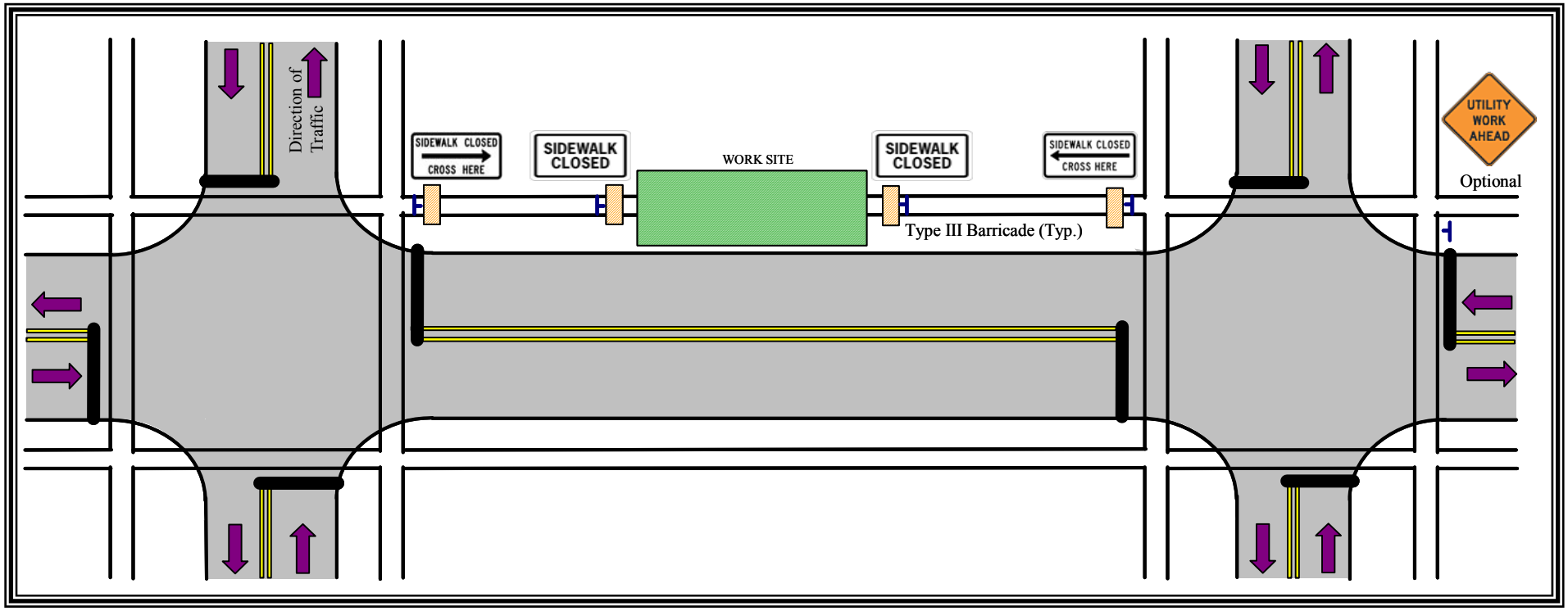
Note: Road Work Ahead, Utility Work Ahead, Worker Symbol sign may be substituted for Tree Work Ahead Sign

Tree Cutting/Trimming Lane Closure on a Multi-Lane Road



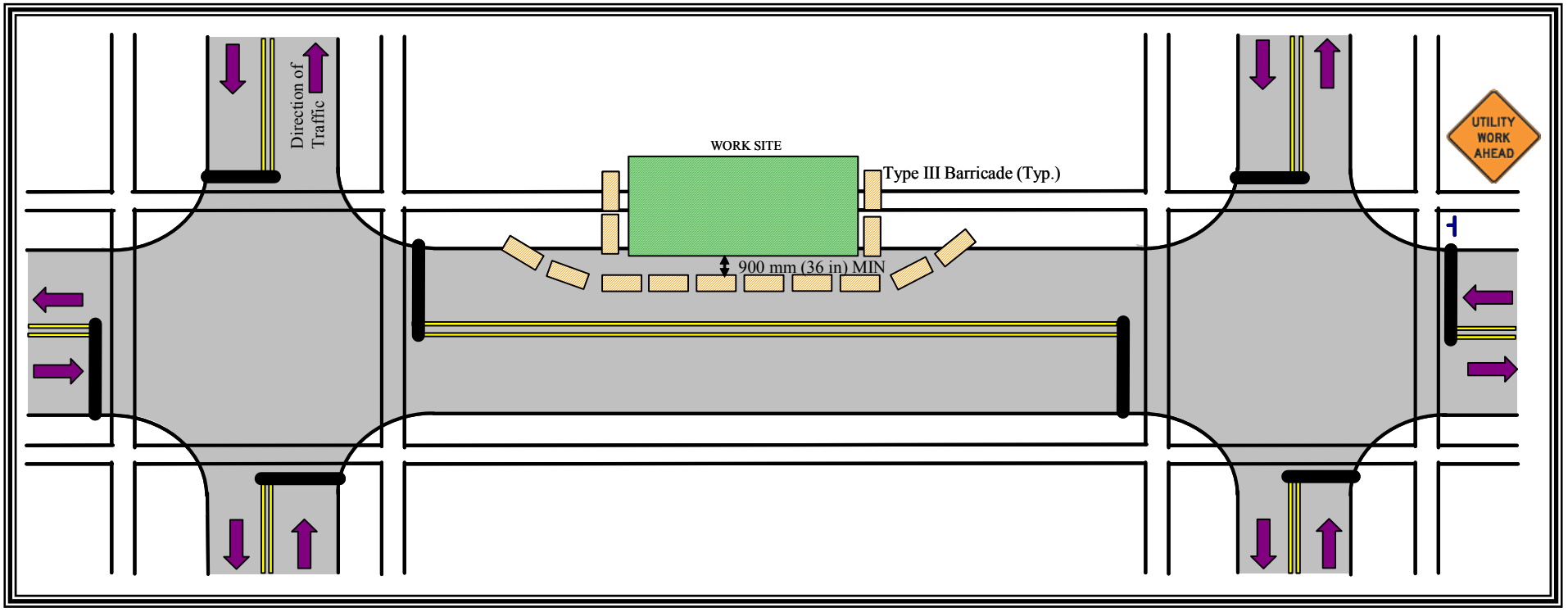
Note: Road Work Ahead, Utility Work Ahead, Worker Symbol sign may be substituted for Tree Work Ahead Sign

Sidewalk Detour for Pedestrians



Note: Sidewalk Closed signs are representative of several wording and direction options available

Sidewalk Diversion for Pedestrians



FOREWORD

National Grid's vision is to be a world-class safety organization, with zero injuries every day. A critical component of achieving this vision is the careful development, implementation and maintenance of safety procedures. This document, **Work Zone Traffic Control**, provides the minimum standards and specifications for work zone traffic control associated with the utility maintenance, repair and construction on or near roadways or on construction sites.

The procedure is designed to promote uniform and consistent application of these basic principals here at National Grid.

By following this guidelines set forth in Work Zone Traffic Control personnel can reduce their risk of injury and comply with applicable laws and regulations.

Questions regarding this procedure should be referred to National Grid's Safety Department.

Record Of Change

Date of Review/ Revision:

Revision	Date	Description
1	06/01/09	Response to audit item

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1.0 INTRODUCTION

1.1 Purpose

This procedure will provide the minimum standards and specifications for work zone traffic control associated with the utility maintenance, repair and construction on or near roadways or on construction sites. The procedure is designed to promote uniform and consistent application of these basic principals.

The purpose of traffic control devices and reasons for their use is to help ensure roadway safety by providing for the orderly and predictable movement of all traffic and provide safety to both the public and employees.

1.2 Applicability

Equally as important as the safety of road users traveling through temporary traffic work zones is the safety of workers. This procedure applies to National Grid employees whose work exposes them to the risks of moving roadway traffic or construction equipment or interfere with the orderly flow of traffic. This includes maintenance or construction work performed within the highway boundary or on construction sites, either public or private.

Minimum standards of application are prescribed for typical situations. A number of typical scenarios are illustrated in the Utility Work Zone Traffic Control Field Guide, showing proper application of these standards and principles.

1.3 Reviews and Revisions

This procedure shall be reviewed periodically and revised as required. Revisions of this procedure should be made as a result of regulatory changes, management review, change in safety management guidance, or company policies. The dates of reviews and revisions will appear on the front of the page of the procedure titled “Record of Change”.

The Safety Programs and Regulatory Compliance Group shall have primary responsibility for maintaining this document, soliciting comment from stakeholders, and revising as necessary. The requirements of this procedure or any future revision thereof, shall be effective the date of its issue unless otherwise noted.

1.4 Documentation

Documentation related to this procedure and subsequent reviews and revisions will be maintained in the Safety Department. This procedure will be accessible to field operations both in paper and electronic formats. The paper versions of the procedure will not be document controlled. The official, current version of this procedure and all other procedures prepared under this guidance will be on the National Grid internal intranet website.

1.5 Quality Assurance and Audit

Internal self-assessment and quality assurance activities are performed at several levels. Local management is responsible for complying with this procedure and with associated work

methods that may be developed. The Safety Department shall be responsible for reviewing and revising this procedure based on feedback from these stakeholders.

The use of this procedure is subject to audit and it is anticipated that the Company' Legal Department and/or Internal Audit will periodically review its implementation.

2.0 RESPONSIBILITIES

2.1 Line of Business (LOB)

- Ensure that all employees are trained in Work Zone Traffic Control
- Monitor compliance with this procedure and note conditions where application of this procedure does not provide adequate worker protection.

2.2 Safety Department

- Provide on-going technical assistance to LOB as requested

2.3 Learning and Development

- Develop Work Zone Traffic Control training for LOB's.
- Conduct training for all workers exposed to the risks of moving roadway traffic or construction equipment.
- Conduct refresher training as needed to address needs and changes in regulatory requirements.
- Maintain training records in training database

2.4 Employees

- Adhere to the requirements of this procedure
- Attend all required training
- Request additional information when necessary

3.0 APPLICATION

It is not possible to prescribe detailed standards of the application for all situations that may conceivably arise. Therefore, typical illustrations are presented in the *Utility Work Zone Traffic Control Field Guide* for the most common situations with the understanding that additional protection may be required where special complexities and hazards prevail. Although each situation must be dealt with individually, conformity with the provisions established herein is required. The protection described for each situation shall be based on the **speed and volume of traffic, duration of work, and exposure to hazards**.

These standards are basically applicable to both rural and urban situations. High speed highways and streets require more thorough treatment than the minimum requirements, whereas low speed may be treated satisfactorily with a minimum of devices.

3.1 Standardization

3.1.1 All traffic control devices used on maintenance and construction projects shall conform to the applicable specifications of this manual.

3.1.2 Signs shall be kept in proper position, clean and legible at all times. Damaged, defaced or dirty signs shall be cleaned, repaired or replaced.

3.1.3 Barricades and signs supports shall be neatly constructed and shall not appear makeshift. They shall be repaired, cleaned or replaced as needed to keep up their appearance.

4.0 FUNDAMENTAL PRINCIPLES OF WORKZONE TRAFFIC CONTROL

4.1 Plan for Safety

Workers should plan ahead for the safety of the motorist, pedestrian and worker.

4.2 Keep it Moving

Normal traffic movement should be disrupted as little as possible.

4.3 Communicate

Motorists and pedestrians should be warned, informed and guided in a clear and positive manner while approaching and traveling through the work zone.

4.4 Plan for the Worst

Workers should plan for the possibility of errant vehicles leaving the roadway and impacting the work zone.

4.5 Train

Each person whose actions affect temporary traffic control zone safety should receive training appropriate to the job decisions each is required to make. Only those who are trained in safe traffic control practices and have a basic understanding of the principles and National Grid's procedures should supervise the selection, placement and maintenance of traffic control devices in work zones.

5.0 THE WORK AREA MUST BE PLANNED

Traffic congestion makes it necessary to plan protection for our work areas. Planned protection is necessary to avoid vehicle and pedestrian traffic hazards for the safety of the public and our own employees.

The vital nature of our services makes it necessary to provide them with a minimum of interruption. We must gain access, to our facilities and equipment, as repair and maintenance is required, providing a work area that is safe for all concerned.

It is National Grid's goal to maintain good relations with the general public. Employees in the field can create public goodwill by the way they conduct themselves and the way they arrange and maintain the traffic work zone.

You can help to maintain a reputation as a good neighbor by making it your standard work practice to use these principles of work zone traffic control.

5.1 Planning Considerations

5.1.1 Maintain street work areas for only as long as is absolutely necessary to quickly and safely move in, do the job, and move out, minimizing obstructions to traffic and exposure to accidents.

5.1.2 Plan according to the work area and duration of work.

5.1.3 Consider the character of the area around the work zone.

5.1.4 Install and securely anchor approved bridging over excavations where pedestrian and vehicular traffic must be maintained during the job.

5.1.5 Take special care to provide suitable boundary definitions and/or barricades to make pedestrians and drivers of vehicles aware of work area boundaries.

5.1.6 Plan in advance for:

- Speed of traffic
- Volume of traffic
- Any changes in the above which may occur during the work operation
- Duration of work
- Traffic approaches
- Pedestrian traffic
- Work vehicle movements above work zone

5.1.7 Maintain the smallest work area consistent with safe operations being guided by the following limitations:

a. Width of work area. The width of a work area, generally, should not exceed the width of one traffic lane. The job should be worked in steps; or in congested areas with unusual traffic conditions, notify appropriate police agency and/or DOT officials.

b. Length of work area. Whenever possible, place tools, equipment, vehicle, or other suitable barriers between the working point and oncoming traffic. Additional area required for essential equipment may be obtained by increasing the work area in the direction of the flow of traffic.

5.1.8 Day or night, warning lights on vehicles and barricades should be operating before moving out into traffic lanes.

5.1.9 Planned consideration should be given for a flagger when the work area extends into traffic lanes. The flagger shall be equipped with a stop and slow paddle and Class 2 or higher high visibility/reflective outer clothing. Channelization is preferred to flagging operations, when two-way traffic can be maintained.

5.1.10 Determine in advance the need for specific traffic control devices including additional special equipment which may be necessary. Consider who will install, maintain and remove the devices. For proper procedure concerning installation and removal of these devices, refer to Section 7.0.

5.1.11 Plan where work material and equipment will be stored.

5.1.12 Consideration should be given to preparation of an emergency traffic plan for unexpected incidents which cause complete closure of a roadway.

5.1.13 Refer to the Typical Control Plan diagrams (TCP's) in the Utility Work Zone Traffic Control Field Guide and select the setup which most closely meets your requirements, adapting it where necessary to meet local conditions.

5.1.14 For night operations or work areas left with traffic restrictions at night, illumination may be required in addition to flashing and steady lights on warning and guide devices.

6.0 SELECTING THE TYPICAL APPLICATION

Selecting the most appropriate typical application for a temporary traffic control zone requires knowledge and understanding of that zone. Three factors are used to characterize the typical applications: speed and volume (roadway type), duration of work and exposure to hazards.

Work duration is a major factor in determining the number or types of devices used in temporary traffic control zones. The five categories of work duration and their time at a location are as follows:

6.1 Duration of Work

6.1.1 Long-Term Stationary

Work that occupies a location more than three days.

At long-term stationary temporary traffic control zones, there is ample time to install and realize benefits from the full range of traffic control procedures and devices that are available for use. Generally, larger channelizing devices are used, as they have more retro- reflective material and offer better nighttime visibility. The larger devices are also less likely to be displaced or tipped over-an important consideration during those periods when the work crew is not present. Furthermore, as long-term operations extend into nighttime, retro-reflective and/or illuminated devices are required.

6.1.2 Intermediate-Term Stationary

Work that occupies a work location for more than one daylight period up to three days, or nighttime lasting more than one hour.

Typically, the work zone is occupied by excavations, materials, and/or equipment at times when workers are not present. At least one advance warning sign should face each direction of traffic approaching a long duration stationary work area. When such an area uses a portion of the roadway, channelizing devices should be used. For long duration work areas, larger signs and more conspicuous channelizing devices are usually warranted to control traffic. Conditions normally require attention by the person responsible for traffic control during work of long duration. Warning, delineation and channelization devices should be effective under varying conditions of light and weather. Devices should be kept current and flagger signs should be covered or turned from view when the flagger is not on duty.

6.1.3 Short-Term Stationary

Work that occupies a work location for more than 1 hour, within a single daylight period.

Most utility operations are short-term stationary work. The work crew is present to maintain and monitor the temporary traffic control zone. The use of a flagger is an option depending on road speed and volume. Lighting and/or retro-reflective devices should be chosen to accommodate varying seasonal, climatic, and visibility situations.

This would be work of a type that at the conclusion of the work day or emergency period, the area is returned to its original state in regard to traffic restrictions. It includes operations such as overhead utility repair, and work on underground utilities at manholes. At least one advance warning sign shall face each direction of traffic approaching the work area. When such an area occupies a portion of the roadway, channelizing devices should be used. As the size of a work area that occupies a travel lane increase, the number of traffic control devices should be increased. For short duration stationary work areas, portable signs, consistent with the need for advance warning and adequate notice, supplemented with cones and barricades are generally sufficient to control traffic.

6.1.4 Short Duration

Work that occupies a location up to one hour.

During short duration work, there are hazards involved for the crew in setting up and taking down the traffic controls. Also, since the work time is short, the time during which motorists are affected is significantly increased as the traffic control is expanded. Considering these factors, it is generally held that simplified control procedures may be warranted for short duration work. Such shortcomings may be offset by the use of other, more dominant devices such as special lighting units on work vehicles, such as arrow displays and flashing beacon lights.

It includes operations such as tree-trimming, overhead utility repairs and work at underground utilities at manholes lasting more than 15 minutes at one location.

6.1.5 Mobile Work

Work that moves intermittently or continuously.

Mobile operations often involve frequent short stops, each as much as 15 minutes long, for activities such as removal of debris from the roadway, operating a power distribution switch, changing a street light lamp, operating a gas valve, gas leak detection operations, surveying, inspections and other utility operations that are similar to stationary operations. Warning signs, flashing beacon lights, flags, and/or channelizing devices should be used. Each worker shall be highly visible to approaching traffic.

Mobile operations also include work activities in which workers and equipment move along the road without stopping, usually at slow speeds. The advance warning area moves with the work area. Traffic should be directed to pass safely. For some continuously moving operations-where volumes are light and visibility is good, a well marked and well signed vehicle may suffice. If volumes and/or speeds are higher, a shadow or backup vehicle equipped as a sign truck, preferable supplied with a flashing arrow display, should follow the work vehicle. Where feasible, warning signs should be placed along the roadway and moved periodically as the work progresses. In addition, vehicles may be equipped with such devices as flags, flashing vehicle lights, truck-mounted attenuators, and appropriate signs. These devices may be required individually or in various combinations, including all of them, as determined necessary.

Safety should not be compromised by using fewer devices simply because the operation will frequently change its location. Portable devices should be used. Flaggers may be used, but caution must be exercised so they are not exposed to unnecessary hazards. The control devices should be moved periodically to keep them near the work area. If mobile operations are in effect on a high-speed travel lane of a multilane divided highway, flashing arrow displays should be used.

6.2 Location of Work

The choice of traffic control needed for a temporary traffic control zone depends upon where the work is located. As a general rule, the closer the work is to traffic, the more control devices are needed.

6.2.1 Outside of the shoulder edge

Devices may not be needed if work is confined to an area 15 or more feet from the edge of the shoulder. Consideration should be given to roadway characteristics, roadway geometrics, and vehicle speed.

A general warning sign shall used if workers and equipment are within 15 feet or less of an uncurbed roadway or 2 feet or less of a curbed roadway.

6.2.2 On or near the shoulder edge

The shoulder should be signed as if work were on the road itself, since it is part of the driver's recovery area. Advance warning signs are needed. Channelizing devices are used to close

the shoulder, direct traffic, and keep the work space visible to the motorist. Portable barriers may be needed to prevent encroachment of errant vehicles into the work space and to protect workers.

6.2.3 On the median of a divided highway

Work in the median may require traffic control for both directions of traffic, through the use of advance warning signs and channelization devices. If the median is narrow, with a significant chance for vehicle intrusion into long-term work sites and/or crossover accidents, portable barriers should be used.

6.2.4 On the traveled way

Work on the traveled way demands optimum protection for workers and maximum advance warning for drivers. Advance warning must provide a general message that work is taking place, information about specific hazards, and actions the driver must take to drive through the temporary traffic control zone.

6.3 Roadway Type

Roadway type is also a primary factor in the use of temporary traffic control zone traffic control devices.

6.3.1 Rural two lane roadways

Characterized by relatively low volumes and high speeds.

6.3.2 Urban arterial roads

Often have lower speeds, but they may require significant controls because of higher traffic volumes and closer spacing of such design features as intersections.

6.3.3 Other urban streets

Characterized with light traffic volumes will generally require fewer more closely spaced devices.

6.3.4 Rural or urban multilane divided and undivided highways

6.3.5 Intersections

6.3.6 Freeways

Major arterials and freeways need the highest type of traffic control, primarily because of high speeds and often high volumes of traffic.

7.0 SIGNS

7.1 Location of Signs

7.1.1 Signs shall be placed where they convey their messages effectively and placement must therefore be accommodated to highway characteristics. Signs shall be so placed that the driver will have adequate time for response.

7.1.2 As a general rule signs shall be located on the right side of the roadway. Where special emphasis is deemed necessary, dual installations may be made which consist of duplicate signs opposite each other on the left and right sides of the roadway. Within a construction or maintenance zone, however, it is often necessary and/or desirable to place signs on portable supports placed within the roadway itself. It is also permissible to mount appropriate signs on barricades.

7.1.3 All signs should be mounted at approximately right angles to the direction of, and facing, traffic which they are to serve. Signs mounted on barricades, or temporary supports may be at lower heights but the bottom of the sign shall be not less than one foot above the pavement elevation. However, higher mounting heights are desirable.

7.2 Regulatory Signs

Regulatory signs (for example, speed limit reductions) impose legal compulsions or restrictions on motorists. Therefore, their use must be officially authorized by the agency having responsible jurisdiction.

7.3 Warning Signs

Warning signs are the most important type of signs used in connection with the maintenance and construction operations. Motorists, properly alerted to the physical conditions ahead, should be able to adjust the operation of their vehicles to safely negotiate the maintenance, construction or detour zone.

Warning signs are normally placed in advance of the condition for which they are intended. The advance posting distance for these signs will vary with the approach speed of traffic, the type of maintenance or construction activity, the roadway conditions, and the number and type of signs and other devices used.

Visibility of each sign should be examined with respect to grade, alignment, road curvature and other possible obstructions on the approach to the sign.

For maximum mobility and safety on certain types of maintenance operations, a large sign may be effectively mounted on a vehicle stationed in advance of the work or moving along with it. This may be the working vehicle itself, as in the case of gas leak mobile and street light work, or a vehicle provided expressly for this purpose. These mobile sign displays may be mounted on a trailer, may be provided with self-contained electric power units for flashing beacons and lights, or may be mounted on a regular maintenance vehicle.

7.4 Guide Signs

Guide signs are used to direct traffic through and around maintenance and construction operations where temporary route changes are necessitated by highway closures and detours.

8.0 BARRIERS AND CHANNELIZATION

8.1 Function

Barriers and channelizing devices, when properly used, are often essential to properly control and direct the movement of traffic through or around maintenance and construction projects.

- 8.1.1These devices are used to mark a limited channel of traffic or to close off sections of highways.
- The work vehicles themselves may be used to protect the work area, particularly in low speed urban districts.
- Consideration should always be given to the need for lighting devices at night.

8.2 Channelization

A very important element, within the system of traffic control devices commonly used in construction or maintenance areas (where a reduction in pavement width is involved), is the taper that is provided for channelization.

8.3 Barricades

Barricades are used to physically block off all or part of a roadway.

- If barricades extend across a roadway and shoulder as a fence, availability of access for maintenance or construction forces must be considered.
- Roadways should be narrowed gradually. This gradual narrowing may be accomplished by means of the barricades themselves or by placing cones, drums, or vertical panels in advance of the barricades. An alternate method is to install the barricades at intervals with each successive barricade extending further into the roadway. At night, consideration should be given to the use of delineators or steady-burning lighting devices to indicate the path to be followed and/or of obstructions within the roadway.
- Barricades may also be used to confine traffic to certain lanes or paths of travel for certain distances. These may be placed longitudinally or transversely to the path of travel. Cones, drums, or vertical panels may be used longitudinally or diagonally.

8.4 Auxiliary Devices

When used to require a change in direction or reduction in the number of lanes available, the change should be made gradually.

8.4.1 Cones

a. Cones shall be predominantly orange in color and may be supplemented with warning flags.

b. Cones should be kept clean and bright for maximum target value.

c. For night time use, they shall be reflectorized or equipped with lighting devices for maximum visibility.

8.4.2 Drums

Drums are less portable than cones but provide greater emphasis. They may be used to surround a work area. Drums shall not be placed in the roadway without advance warning signs.

8.4.3 Warning Lights

Warning lights are used to illuminate and emphasize the existence of obstructions and hazards at night. They may be used as necessary as a supplement to reflectorized signs, barricades and other channelizing devices. Warning lights used in series to supplement channelizing devices should be steady-burning, except that the first two lights in series may flash.

Warning lights consist of steady-burning lights, flashing lights and flashing arrow boards.

a. Steady burning lights include all single-unit, steady-burning, low-intensity lamps which emit yellow light.

b. Flashing yellow lights. They are used for advance warning or for marking a severe or unexpected obstruction or hazard in or near the roadway.

c. Flashing arrow boards. A portable unit, consisting of flashing indications arranged to form an arrow symbol, may be used with standard warning devices on highway obstructing maintenance and construction projects.

   1. A unit may be trailer mounted or it may be mounted on a vehicle and arranged so that it can be displayed or turned from view as necessary.

   2. When these units are used on a moving vehicle, controls and pilot lights should be located so that the message display can be monitored and changed from within the driving compartment of the vehicle.

8.4.4 Work Zone Enhancement Devices

Includes; telescoping bars, portable crowd control barriers, such as Color-cade barriers and other protective devices are used to provide additional measures for keeping pedestrians,

bicyclists, etc. from entering into the work area. Traffic control devices must meet the criteria for NCHRP Report 350 standards. However, common devices such as telescoping bars between cones and Color-cade barriers that are typically used within the work zone are not intended for vehicle protection but to prevent pedestrian incursion into the work zone.

9.0 INSTALLATION AND REMOVAL OF DEVICES

9.1 Protection

Installation and removal of devices, in itself, constitutes highway work that should be protected by means appropriate to the situation, such as hazard vehicle lights and vehicle emergency flashers. Establishing a work area within an intersection, or at a freeway interchange, may warrant greater protection.

9.2 Order of Work

1 Device installation normally proceeds from the beginning of the work zone to the far end. On a two-way road, the less affected direction should be set up before the more affected one. The work vehicle used should move in the same direction as traffic in the roadway half being set up.

2 On a one-way roadway, device removal is normally started at the downstream end with removal of the last work area protection device. Channelizing devices are then removed, from downstream to upstream, with those in advance of the workers continuing to provide protection, until the roadway is cleared. Removal of advance warning signs on the shoulder is normally accomplished with a work vehicle traveling in the direction of traffic flow.

10.0 EMPLOYEES EXPOSED TO VEHICULAR TRAFFIC

10.1 Clothing Requirements

a. High visibility safety apparel is required to maximize employee protection when exposed to the risks of moving roadway traffic or construction equipment.

b. Employees must wear high-visibility safety apparel meeting the requirements of ISEA "American National Standard for High-Visibility Safety Apparel" or equivalent revisions, and labeled as ANSI 107-2004 standard performance for Class 2 or 3 exposure.

c. High-visibility safety apparel is defined as company approved:

   1. Safety vests
   2. Rain gear (jacket or jacket and pants ensemble), or
   3. Garments worn over the outer layer of clothing

d. Flaggers - safety apparel meeting ANSI 107-2004 standard performance Class 3 risk exposure should be considered for:

   - Flagging at night
   - Flagging in inclement weather and similar lowlight conditions
   - Flagging in high speed/volume traffic areas
   - When determined by the competent person in charge

e. Any exception for not wearing high-visibility safety apparel must be valid and must be documented on the job brief by the individual exposed to the risks of moving roadway traffic or construction equipment and by the responsible person in charge.

11.0 FLAGGERS

11.1 Application

Consideration should always be given to the need for flaggers to control traffic on a maintenance or construction project where traffic is permitted to travel through or adjacent to the work area. However, the decision to use or not to use a flagger in a particular situation rests with the person in charge of the operation.

1 STOP/SLOW Paddles. Paddles are the preferred tool to use when performing flagging duties.

2 Flags. A 24" x 24" Red Flag may be used for flagging in emergencies when STOP/SLOW paddles are not available. Red Flags are also acceptable when flagging at four-way intersections.

11.2 Flagger Stations

11.2.1 Flagger stations should be located far enough from the work site so that vehicles will have sufficient distance to slow down before entering the project but not so far that vehicles will tend to speed up into the work site.

11.2.2 Normally the flagger will be positioned adjacent to the traffic lanes being controlled either on the shoulder or in the barricaded lane. At a spot obstruction the flagger should stand on the shoulder opposite the barricaded section.

11.2.3 The flagger should stand alone, never permitting a group of workers to congregate around him or her. The flagger should be stationed sufficiently in advance of the work area to warn workers of approaching danger, such as out-of-control vehicles.

11.2.4A flagger warning sign shall be used facing each direction of traffic. These advance warning signs are optional for very brief periods or emergency traffic control.

11.2.5 Flagger Stations at night time shall be illuminated, except in emergency situations.

11.3 One-Lane Control

Where traffic in both directions must, for a limited distance, use a single lane, provisions should be made for alternate one-way movement to pass traffic, through the constricted section. However, where the one-lane section is of any significant length, there should be some means of coordinating movements (for example, walkie-talkies, hand signals, etc.) at each end so that vehicles are not simultaneously moving in opposite directions in the section and so that delays are not excessive at either end. Control points at each end of the route should be chosen so as to permit easy passing of opposing lines of vehicles.

12.0 VEHICLES IN THE WORK AREA

1 All vehicles in the work area shall activate their vehicle hazard warning flashers in addition to their beacon/flashing lights for the duration of the work.

2 As vehicles approach the work area they should activate their vehicle hazard warning lights along with the beacon/flashing to indicate to traffic that they are slowing down and preparing to enter the work zone.

3 Drivers of vehicles with portable beacon lights shall not attempt to activate or affix the lights to the vehicle while driving.

4 Beacon/Flashing lights are intended as hazard warning lights. These lights are not considered “Emergency Response Lights” and should not be used as such. It is, however permissible to use the Beacon/Flashing light while performing patrol or shadow vehicle activities when the vehicle speed is below the normal speed limit creating a potential traffic hazard.

5 All vehicle lights shall be approved for use by Fleet and only used in accordance with manufacturers’ instructions, local, state and federal law.

13.0 REFERENCES

13.1 49 CFR, Manual of Uniform Traffic Control Devices. 2003, rev 1 & rev2

13.2 NYCRR, Title 17, Volume (b), Chapter V, Uniform Traffic Control Devices.

13.3 29 CFR 1926.201 - Signaling,

13.4 29 CFR 1926.202- Barricades,

13.5 29 CFR 1926.203- Definitions,

13.6 29 CFR 1910.269, Electrical Power Generation, Transmission and Distribution.

13.7 Utility Work Zone Traffic Control, Wayne State University, August 2008

13.8 ANSI 107-2004

APPENDIX G

HASP ANNUAL CHECKLIST

Rockaway Park Former MGP Site HASP Annual Checklist	
Have all National Grid procedure revisions been incorporated into HASP?	
Are there any new procedures to be incorporated into the HASP?	
Is all contact information in the HASP current and correct?	
Has the scope of work changed? If so, are changes reflected in HASP?	
Does the Activity Hazard Analysis need to be revised?	
Have any attributes of LIPA property and associated procedures and regulations changed?	
Has GEI obtained the most recent as-built drawings of the transmission/distribution line layout from National Grid?	

APPENDIX H

EMERGENCY EVACUATION PLAN

Emergency Evacuation Plan

In the event of severe weather, a chemical emergency, a fire, or other hazard which warrants evacuation of the personnel onsite or working within the Bay Shore community; the following procedures will be strictly adhered to:

1. **IF THE EMERGENCY IS SITE-WIDE (such as severe inclement weather), SOUND THE ALARM** All staff vehicles are equipped with an air horn. The emergency signal blast with the air horn should be a single blast lasting approximately **30 seconds**. If another horn blast happens to occur at the same time or during your blast, do not discontinue yours. Complete your emergency signal. Be aware that other emergency blasts may occur in the event of an emergency.

   IF THE EMERGENCY IS LOCALIZED (such as a fire in the trailer or an accident in the work zone) you do not need to sound the alarm with the air horn. You must yell **FIRE, FIRE, FIRE,** (or other emergency) repeatedly. Make sure that at least one other employee has heard and understood the alarm.

2. **NOTIFY/CALL 911 EMERGENCY OPERATOR.** The employee first observing the fire or other hazard will relocate outside of the immediate area of the hazard,

   DIAL 911 and
   Report the emergency situation indicating that
   THERE IS A FIRE OR OTHER TYPE OF AN EMERGENCY AT:

   [Name and location of emergency]
   The National Grid Rockaway Park Former MGP Site
   Give Address

3. **EVACUATE!** Select the closest, safest route to exit the site or building and proceed in an orderly and expeditious manner to a prearranged meeting area outside. While in route to the exit, assist in the notification of other employees by re-sounding the alarm to evacuate**. FIRE, EVACUATE!!! FIRE, EVACUATE, FIRE, EVACUATE!!!** While in route from the building(s) or site, take the time to notify the other employees and occupants in the area of the emergency and the necessity for evacuation. For a site-wide evacuation, follow the designated path on the Emergency Evacuation Map.

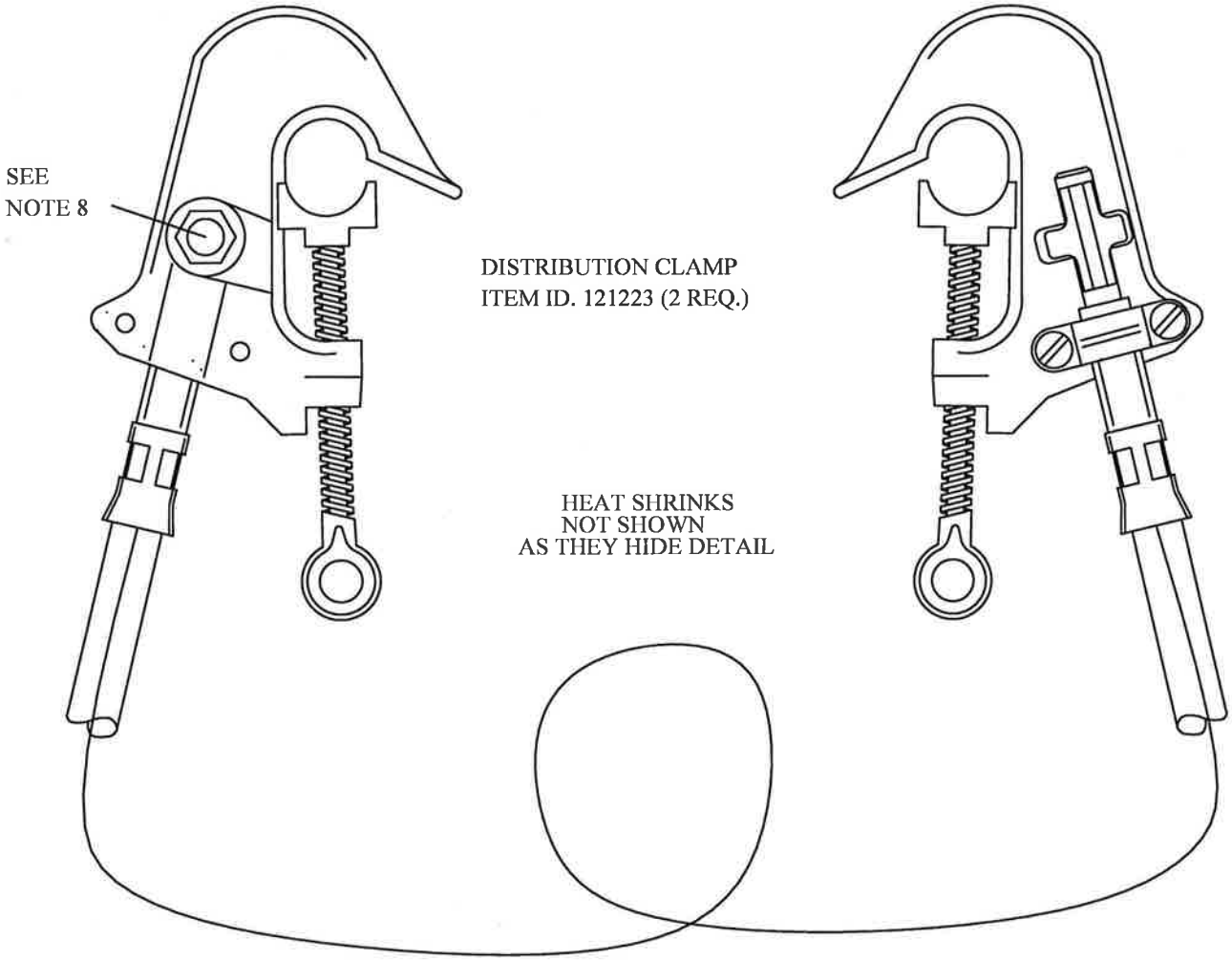
4. **ASSEMBLE:** After you have heard the GEI air horn emergency signal or after you have been clearly notified by other personnel that you must vacate and/or evacuate your area, you must immediately relocate to the **DESIGNATED GEI ASSEMBLY AREA** .The designated assembly area will be an area outside your work zone that is a **safe distance from the emergency**. Secure your work area if necessary, and if possible**.** As you exit the building or job site, select the closest and safest route and proceed in an orderly manner to the **DESIGNATED ASSEMBLY AREA** where a head count will be taken to ensure that everyone has safely evacuated**. The first person to arrive will conduct the headcount. Use the sign-in sheet (if possible) to help determine who is present onsite, but also be sure to determine from other employees who is onsite at well (include sub-contractors). Sub-contractor crew chiefs must inform GEI of employee presence.** Be especially cautious as you cross traffic lanes for arriving emergency vehicles and other moving private vehicles.

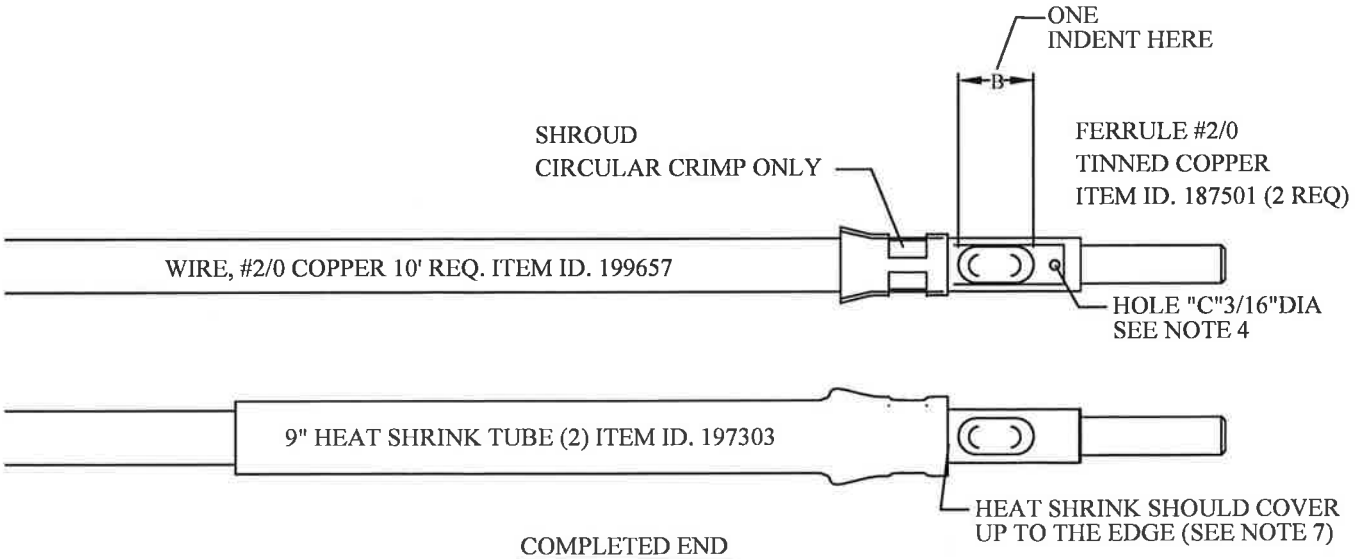
5. Remain in the assembly area until released to return to work or instructed otherwise.

6. Notify the GEI Project Manager, GEI Corporate Health and Safety Officer, and the National Grid Project Manager of the emergency and actions taken by site personnel.

APPENDIX I

LIPA POLICIES

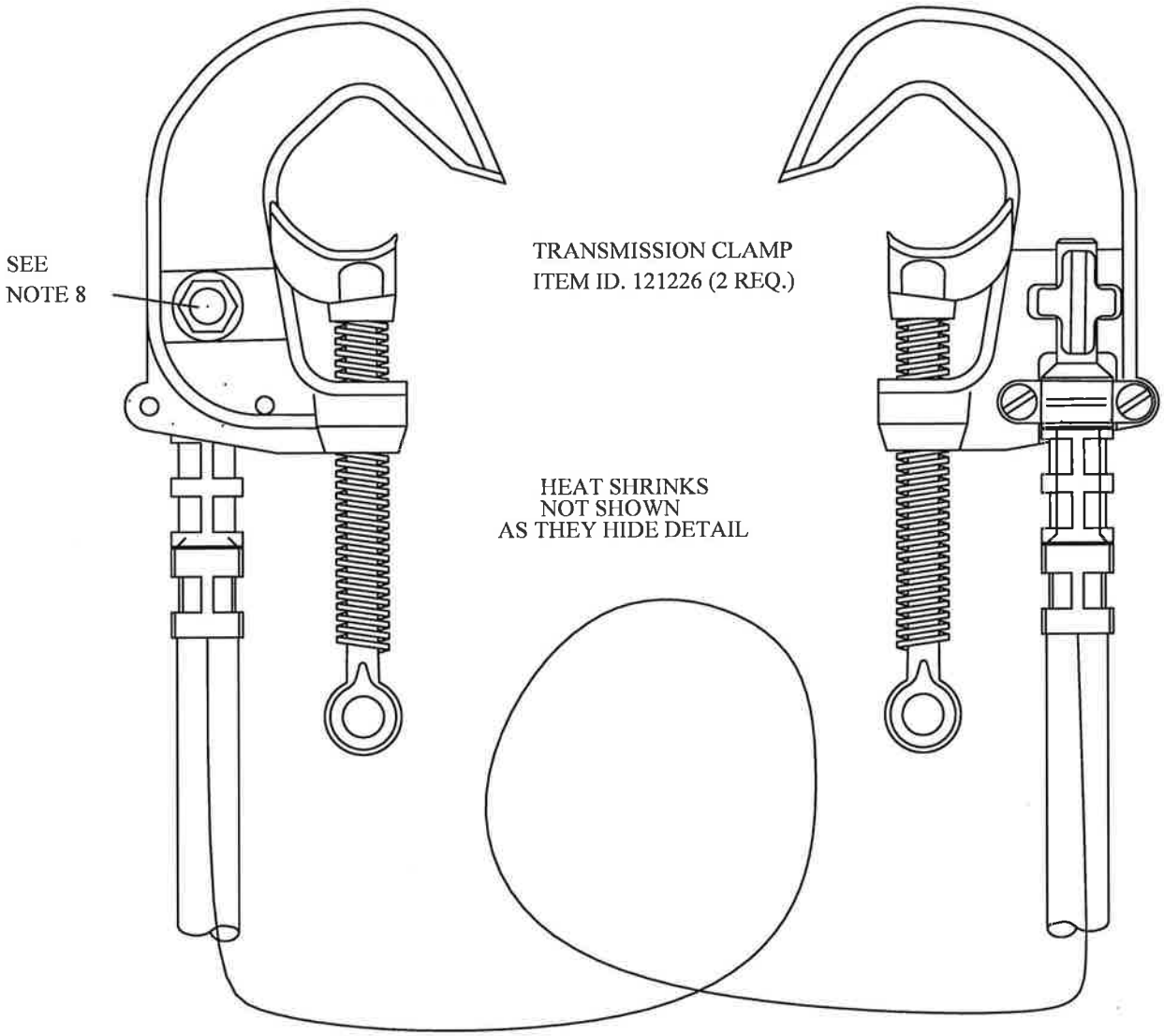


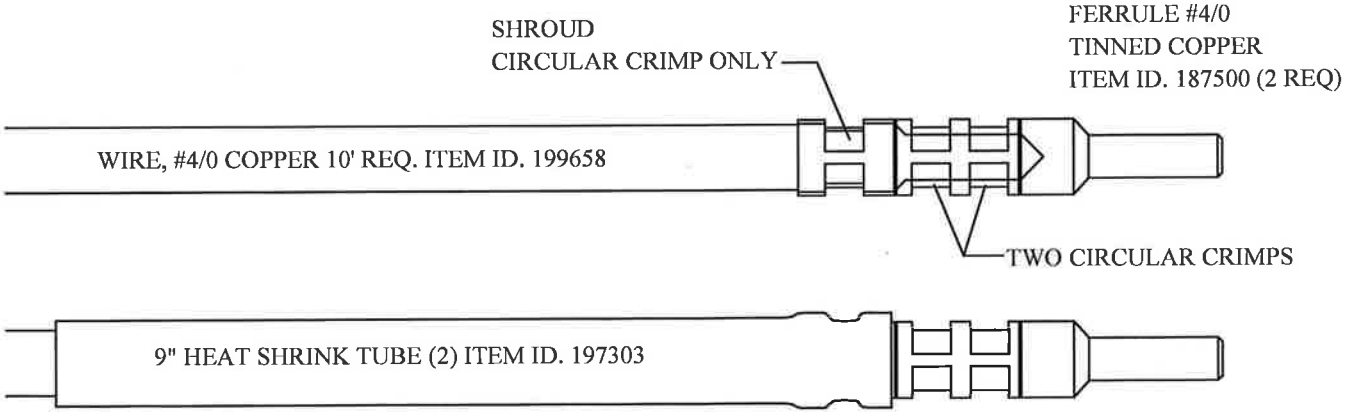


COMPLETED END

SEE SHEET 3 FOR PROCEDURE

APPROVED BY	REVISION	GROUNDING PRACTICES: GENERAL	CONSTRUCTION STANDARD DRAWN BY AH		
DATE: 09/14/04	12. 08/04: GENERAL UPDATE	PORTABLE GROUNDING ASSEMBLIES DISTRIBUTION (#2/0)	NUMBER	SHEET No	REV
LONG ISLAND POWER AUTHORITY			3575	1 of 3	12
prepared by KeySpan Energy Corporation					





COMPLETED END

SEE SHEET 3 FOR PROCEDURE

REVISION		GROUNDING PRACTICES: GENERAL	CONSTRUCTION STANDARD DRAWN BY AH		
	12. 08/04: GENERAL UPDATE	PORTABLE GROUNDING ASSEMBLIES TRANSMISSION (#4/0)	NUMBER	SHEET No	REV
LONG ISLAND POWER AUTHORITY KeySpan Energy Corporation			3575	2 of 3	12

NOTE: THE TWO CLAMPS FOR ONE ASSEMBLY MUST BE THE SAME.

PROCEDURE

1. CUT CABLE TO 10 FOOT LENGTH.

2. REMOVE NEOPRENE INSULATION AND PAPER SEPARATOR FOR DISTANCE INDICATED IN TABLE I.

3. PENCIL INSULATION FOR A DISTANCE OF 5/16" IF INDICATED IN TABLE I.

4. CHECK HOLE MARKED "C" (IF AVAILABLE) TO BE SURE THAT CONDUCTOR IS SNUG IN FERRULE.

5. APPLY INDENT OR CIRCULAR CRIMP WITH APPROPRIATE TOOL IN SECTION MARKED "B".

6. APPLY CIRCULAR CRIMP ON FERRULE COLLAR.

7. APPLY A 9" LONG HEAT SHRINK TO PROVIDE A SEAL BETWEEN THE FERRULE AND CONDUCTOR CONNECTION. IF HOLE "C" DOES EXIST SOLDER FILL THE HOLE COMPLETELY TO SEAL IT.

8. TORQUE 1/2" HARDWARE TO 25 FOOT POUNDS, AFTER ITEMS HAVE BEEN ASSEMBLIED.

TABLE I

FERRULE SIZE	REMOVE INSULATION	PENCIL LENGTH	TOOL	DIE	
				SECTION "B"	SHROUD
4/0	2"	-	Burndy Y-35	U - L	U - L
2/0	1"	5/16"	Burndy Y-35	U - 658 & Y35P3**	U - 658
			Burndy Y-34A ***	Nest A27D Indent Y34PR - 2	A - 658
			Amp 69099M1 *	46767 - 2 (2/0)	-

*For General Shops Use Only
**Must use 1/2 of each die set to make one indent crimp.
***May not work with ferrules from every manufacturer.

REVISION		GROUNDING PRACTICES: GENERAL	CONSTRUCTION STANDARD DRAWN BY AH		
	12. 08/04: GENERAL UPDATE	PORTABLE GROUNDING ASSEMBLIES #2/0 AND #4/0	NUMBER	SHEET No	REV
LONG ISLAND POWER AUTHORITY prepared by: KeySpan Energy Corporation			3575	3 of 3	12

APPENDIX J – COMMUNITY AIR MONITORING PLAN

GEI Consultants

Consulting
Engineers and
Scientists

Community Air Monitoring Plan

Rockaway Park Former MGP Site

109-11 Beach Channel Drive
Rockaway Park, New York
AOC Index No. D1-0002-98-11
Site No. 2-41-029

Submitted to:
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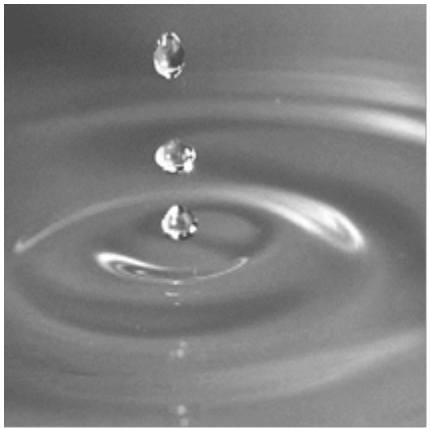
March 2017
Project 093150



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Appendix

A NYSDOH Generic CAMP from DER-10 Appendix 1A

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Abbreviations and Acronyms

CAMP	Community Air Monitoring Plan
CLP	Contract Laboratory Program
CM	Construction Manager
GEI	GEI Consultants, Inc.
MGP	Manufactured Gas Plant
NEMA	National Electrical Manufacturers Association
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PM-10	Respirable Particulate Matter
TVOC	Total Volatile Organic Compounds
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

Executive Summary

This Community Air Monitoring Plan (CAMP) Work Plan has been developed to provide procedures for measuring, documenting, and responding to potential airborne contaminants during intrusive activities below the On-Site Soil Cover system or the Off-Site Composite Cover System ("herein after referred to as the "Cover Systems") associated with the Rockaway Park former Manufactured Gas Plant (MGP) site (Site). The procedures in this CAMP focus on air monitoring techniques and contingency measures designed to mitigate potential airborne contaminants. This CAMP Work Plan is based on the CAMP guidelines established by the New York State Department of Health (NYSDOH) in the New York State Department of Environmental Conservation (NYSDEC) *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10) (NYSDEC, 2010).

The CAMP provides Air Monitoring Procedures, Alert Levels, Response Levels, Action Levels, and Contingency Measures if Action Levels are approached. Alert Levels are National Grid internal established concentration levels for volatile organic compounds only and are not established by the NYSDOH or NYSDEC. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants during remedial activities. A Response Level is a contaminant concentration level that triggers a temporary work stoppage, continued monitoring, and potential contingent measures. An Action Level is a contaminant concentration that triggers work stoppage and implementation of contingent measures to mitigate potential airborne contaminants prior to resuming work activities. Response Levels and Action Levels are NYSDOH threshold levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10. Exceedances of either Response Levels or Actions Levels will be reported to NYSDEC and NYSDOH.

During times of potential related ground intrusive activities below the Cover Systems, perimeter air monitoring will be conducted using one or more of the following monitoring equipment configurations, as appropriate:

- Fixed-station air monitoring equipment,
- Moveable tripod-mounted air monitoring equipment, and/or
- "Walk-around" air monitoring equipment.

Monitoring will be performed for total volatile organic compounds (TVOC) and dust along the Site perimeter 24 hours a day when fixed stations are used or during working

hours if the movable tripod-mounted units are used. The Contingency Plan defines Alert Levels, Response Levels, Action Levels, and specific contingency measures to be implemented. The response actions, potentially including work stoppage and work area controls by various methods, are intended to prevent or significantly reduce the migration of airborne contaminants from the Site.

National Grid's Air Monitoring Consultant (herein referred to as "Consultant") will implement the CAMP and will report any exceedance of Response Levels and Action Levels to the Contractor, the Construction Manager, National Grid, NYSDOH, and NYSDEC. As specified in the DER-10, all 15-minute readings will be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. The contractor conducting intrusive activities below the Cover Systems will be responsible for enacting contingency measures to respond to Alert Levels, if necessary, and to the exceedances of Response and Action Levels as they may occur. The Consultant will provide data summary reports to the Contractor, the Construction Manager, National Grid, and NYSDEC each week during ground intrusive activity below the Cover Systems or at the completion of the work.

1. Introduction

The New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP), as presented in New York State Department of Environmental Conservation's (NYSDEC) document *DER-10 Technical Guidance for Site Investigation and Remediation*, recommends that real-time monitoring for total volatile organic compounds (TVOC) and particulates (i.e. dust) be conducted at the downwind perimeter of each designated work area during ground intrusive activities at contaminated sites. As such, this work plan describes the proposed air monitoring means and methods that will be implemented during intrusive activities below the Cover Systems at the Rockaway Park Former MGP Site (Site). A site location map is shown in Figure 1.

The purpose of the CAMP is to provide early detection in the field of potential short-term emissions and will be conducted in accordance with the generic NYSDOH CAMP.

The objectives of the CAMP are as follows:

- Provide an early warning system to alert the Contractor, the Construction Manager (CM), National Grid, and NYSDEC that concentrations of TVOC or dust in ambient air are approaching Action Levels due to Site activities.
- Provide potential contingency measures to be enacted by the contractor conducting intrusive activities below the Cover Systems and related contractors that are designed to reduce the off-site migration of contaminants if established Action Levels are approached or exceeded.
- Determine whether construction controls are effective in reducing ambient air concentrations to below Action Levels and make appropriate and necessary adjustments.
- Develop a permanent record that includes a database of perimeter air monitoring results, equipment maintenance, calibration records, and other pertinent information.

1.1. Roles and Responsibilities

The Consultant will implement the monitoring and reporting components of this CAMP under contract with National Grid. The contractor performing intrusive activities below the Cover Systems is responsible for the selection and implementation of appropriate contingency measures that will mitigate the off-site migration of contaminants in

response to Action Levels being approached or exceeded. The remainder of this section specifies the roles and responsibilities of each entity relative to the CAMP. A communication flowchart is shown in Figure 2 with each entity and lines of communication for the CAMP.

1.1.1 Air Monitoring Consultant

The scope of the Consultant's activities will be limited to CAMP monitoring and reporting used for the CAMP. The Consultant is responsible for the Health and Safety of their employees. The Consultant's CAMP roles and responsibilities are as follows:

- The Consultant will monitor and record TVOC and dust at various locations around the Site as described in the following sections of this CAMP.
- On a daily basis, the Consultant will communicate to the following entities whether TVOC or dust exceeded Response Levels or Action Levels specified in Section 2.1, and suggest corrective actions required to address the situation. The Consultant will convey the CAMP results to the entities listed below and inform them if the Alert or Response Levels have been exceeded. The Consultant will direct contractors at the Site to take action if warranted.
    - **Contractor – TBD**
    - **New York State Department of Environmental Conservation**
      Mr. Douglas MacNeal, P.E. – Environmental Engineer 2
      Division of Environmental Remediation, NYSDEC
      Office: (518) 402-9564
      625 Broadway
      Albany, New York 12233-7014
    - **National Grid**
      Thomas Campbell, Project Manager
      Office: (516) 545-2555
      175 East Old Country Road
      Hicksville, NY 11801
    - **Construction Manager - TBD**
- The Consultant will provide, maintain, and operate the equipment used to implement the CAMP.
- The Consultant will provide data summary reports to the Contractor, CM, National Grid, and NYSDEC each week during intrusive activity. The reports

will identify Response Level and Action Level exceedances and will include data summary reports for all TVOC and dust data collected.

1.1.2 Contractor

The Contractor is the lead contractor responsible for site activities pertaining to the intrusive activities below the Cover Systems. The Contractor will be responsible for taking contingent actions in conjunction with National Grid in response to Response Level and Action Level exceedances. The Contractor will be responsible for taking contingent actions for Alert Levels, if required by the Consultant, CM, and /or National Grid. The Contractor is responsible for the Health and Safety of their employees.

1.1.3 National Grid

National Grid has the responsibility to provide mitigation services related to the release of Manufactured Gas Plant (MGP)-related vapors in excess of CAMP Response Level and Action Levels. National Grid is also ultimately responsible for the remediation of and maintenance of engineering controls at the Site under an approved work plan with NYSDEC.

1.1.4 New York State Department of Environmental Protection

NYSDEC is responsible for the environmental regulatory enforcement for all activities conducted at the site including compliance with this CAMP, stormwater runoff mitigation (erosion and sediment control), and all environmental and remediation regulations, policies, and guidance applicable to the Site. NYSDEC may provide on-site oversight personnel for the work being conducted.

1.1.5 Construction Manager

During larger intrusive work, National Grid may hire a separate CM; for smaller projects, the Consultant may serve as the CM. The CM is National Grid's representative on site and is responsible for day to day operations on the Site. The CM will be responsible for directing the Contractor to take contingent actions in conjunction with National Grid in response to Alert Level (volatile organic compounds (VOC) only), Response Level, and/or Action Level exceedances. The CM is responsible for the Health and Safety of CM employees and subcontractors.

2. Sampling and Analytical Procedures

This section of the CAMP presents a detailed description of the air monitoring sampling and analytical procedures, including data management that will be used during ground intrusive site activities. The intent of the real-time monitoring program is to provide early detection in the field of short-term emissions and off-site migration of site-related TVOC and dust.

Real-time sampling methods will be utilized to determine ambient air concentrations during the project. Monitoring for TVOC and respirable particulate matter (PM-10) will occur at a minimum of two locations. Wind direction will be monitored under all monitoring approaches. A meteorological station will be established if a centralized data logger system is implemented. Supplemental walk-around perimeter monitoring for TVOC and PM-10, will occur along the perimeter of the project site on an as-needed basis. In the event of a possible exceedance of a Response Level or Action Level for TVOC or PM-10, the Consultant will compare upwind to downwind concentrations within 60 minutes of the possible exceedance to determine if site activity is causing the Response Level or Action Level exceedance. The air monitoring procedures and equipment are detailed below.

2.1 Alert Level, Response Level, and Action Levels

Alert Levels are not established by the NYSDOH or NYSDEC and are National Grid internally established concentration levels for TVOC only. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants during remedial activities.

A Response Level is a contaminant concentration level that triggers a temporary work stoppage, continued monitoring, reporting, and potential contingent measures. A Response Level serves as a screening tool for both TVOC and PM-10 to trigger contingent measures to assist in minimizing off-site transport of contaminants during remedial ground intrusive activities. Response Levels are NYSDOH thresholds levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10.

An Action Level is a contaminant concentration that triggers work stoppage and implementation of contingent measures to mitigate potential airborne contaminants prior

to resuming work activities. Action Levels are NYSDOH threshold levels established in the May 2010 NYSDOH Generic CAMP presented in Appendix 1A of DER-10.

For example, if high concentrations of dust are detected on the Site, contingent measures such as the use of spraying water may be required to reduce the concentrations and keep them below Response Levels.

The following target compounds and corresponding Response Levels, and Action Levels were developed in accordance with the NYSDOH Generic CAMP. Alert Levels are National Grid internally established concentration levels for TVOC only.

Target Compounds	**Alert Level**
TVOC (15-minute average concentration)	3.7 ppm greater than background*
Target Compounds	**Response Level**
TVOC (15-minute average concentration)	5.0 ppm greater than background*
Respirable Particulate Matter (PM-10)	100 $\mu g/m^3$ greater than background*
Target Compounds	**Action Level (**)**
TVOC (15-minute average concentration)	25 ppm greater than background*
Respirable Particulate Matter (PM-10)	150 $\mu g/m^3$ greater than background*

ppm - parts per million
$\mu g/m^3$ - micrograms per meter cubed
TVOC – total Volatile Organic Compounds
* Background is defined as the current upwind fifteen-minute average concentration.
** Action Level Exceedance requires work stoppage and mitigation of the condition causing the exceedance.

2.2 Air Monitoring Procedures

During times of potential related ground intrusive activities below the Cover Systems, perimeter air monitoring will be conducted using one or more of the following monitoring equipment configurations, as appropriate:

- Fixed-station air monitoring equipment,
- Moveable tripod-mounted air monitoring equipment, and/or
- "Walk-around" air monitoring equipment.

Monitoring will be performed for TVOC and dust along the Site perimeter 24 hours a day when fixed stations are used or during working hours if the movable tripod-mounted units are used.

Monitoring for TVOC and PM-10 will occur at a minimum of two locations using real-time sampling equipment. Readings will be checked manually on a predetermined,

periodic basis if tripod-mounted units are used or transmitted to a centralized data logger system station once per minute. Depending on the units used, monitoring will be conducted during working hours or 24 hours a day 7 days a week during construction activity along the Site perimeter. Supplemental "walk-around" perimeter monitoring for TVOC and PM-10, and odor will occur along the perimeter of the project site on an as-needed basis. Each approach is detailed below.

It is anticipated that tripod-mounted stations will be used for minimally intrusive work such as installation of soil borings or monitoring wells and during shallow intrusive work during utility installation and maintenance. It is anticipated that fixed stations will only be used in the event of significant excavation work below the Cover Systems at the Site.

2.2.1 Fixed-Station Monitoring Procedures

Real-time air monitoring for TVOC and suspended particulates will be conducted upwind and downwind of the work area along the Site perimeter during significant excavation below the Cover Systems at the Site. Instruments will be positioned to monitor around the active excavation work zone based on a particular day activities at a minimum of two locations adjacent to the work area. Real-time monitors will continuously gather data 24 hours a day 7 days a week. The air monitoring system consists of a minimum of two air monitoring stations, one meteorological tower, and one central computer system. The central computer system will be located in the project trailer or similar work area.

The real-time fixed air monitoring stations will be positioned between the work zone and the largest number of potential off-site receptors. Therefore, the placement of the fixed air monitoring stations is based on the need to document all potential off-site migration on the perimeter, but also recognizes the potential off-site receptors and the location of the proposed construction activities. Figure 3 displays a typical arrangement of fixed air monitoring stations around the Site.

Each real-time air monitoring station contains the following:

1. Station enclosure
2. An organic vapor analyzer
3. A particulate monitor
4. A radio telemetry device

Each monitoring station is housed in a weather-tight National Electrical Manufacturers Association (NEMA)-4 type enclosure. Each monitoring station will continuously measure and record TVOC and PM-10 at a rate of one sample per minute and record 15-

minute time-weighted running averages. Figure 4A shows an example of a typical fixed air monitoring station.

In addition to the air monitoring stations, a Campbell Scientific, Inc. Met Data1 meteorological monitoring system, or equivalent, will be established on site. The meteorological system will continuously monitor temperature, relative humidity, wind speed, and wind direction. Fifteen-minute average values for each meteorological parameter will be stored in the meteorological system and downloaded once per week. Wind direction and wind speed will be displayed on the central computer in real-time to determine upwind and downwind stations for assessing Alert, Response, and Action Levels. Upwind and downwind stations will be reduced real-time. Windsocks and/or flags may be placed at locations around the site to obtain real-time site-specific wind direction.

All TVOC, PM-10, and meteorological data will be stored in data loggers located within each monitoring/meterological station. Stored analytical data along with system performance data from each station will be sent in real-time, via radio telemetry, to the Site central computer system for monitoring and analysis. The meteorological station will be downloaded at a minimum of once per week. In the event of severe weather or power loss at the site, data recording and/or recovery may be affected.

2.2.2 Tripod Mounted Monitoring Procedures

It is anticipated that tripod-mounted stations will be used for minimally intrusive work such as installation of soil borings or monitoring wells and during shallow invasive work during utility installation and maintenance. Instruments will be positioned along the Site perimeter to monitor the air based on a particular day ground intrusive activities at a minimum of two locations (upwind and downwind). Real-time monitors will continuously gather data during periods of intrusive activity during working hours. The equipment will be manually read on a predetermined periodic cycle during the work activity.

The readings will be collected at a minimum of 15-minute intervals during periods of intrusive activities. Wind direction will be determined by using a wind sock or flagging placed on a pole at the Site.

Each air monitoring station would include the following:

1. Station Tripod and enclosure
2. An organic vapor analyzer
3. A particulate monitor

Figure 4B shows an example of a typical tripod-mounted air monitoring station.

Each monitoring station will continuously measure and record TVOC and PM-10. All TVOC and PM-10 will be stored in data loggers located within each monitoring station. Data from each piece of equipment will be downloaded daily at the completion of intrusive activities and stored on a central computer system. The location of each station, the work zone, and the wind direction will be noted daily. At each monitoring station location, the 15-minute average value of TVOC and PM-10 will be recorded. The 15-minute average value of TVOC and PM-10 data from the upwind and downwind station will be compared and resultant downwind concentration will be calculated and recorded.

2.2.3 Supplemental Perimeter Walk-around Monitoring

Supplemental walk-around perimeter monitoring for TVOC and PM-10 will occur along the perimeter of the project site on an as-needed basis. Specific site conditions that may trigger walk-around perimeter monitoring include:

- Visible dust
- Detection of TVOC and/or PM-10 at an air monitoring station at concentrations exceeding an Alert Level, Response Level, and Action Levels
- Direction by the CM, National Grid, and/or NYSDEC

Fifteen-minute average TVOC and PM-10 readings will be collected continuously at a downwind location between the work area and the nearest receptors.

When a triggering condition is observed during ground intrusive activity, the supplemental downwind perimeter monitoring will occur continuously until the conditions that triggered the monitoring have subsided. TVOC concentrations will be monitored and recorded using an organic vapor analyzer. PM-10 will be measured and recorded using a portable aerosol monitor equipped with a PM-10 impactor.

At each monitoring point, the 15-minute average value of TVOC and PM-10, sample time, and sample location will be collected and recorded. Additional temporary monitoring points may be established due to changing site or meteorological conditions.

2.2.4 Equipment Calibration

Equipment calibration will be performed according to manufacturer's instructions. Each organic vapor analyzer will be calibrated once daily using a certified standard isobutylene gas. Particulate monitors for PM-10 will be zeroed daily. Other hand-held portable

equipment will be calibrated before each use, or a minimum of once per week when not in use.

2.3 Volatile Organic Compound (VOC) Analytical Sampling

For significant excavation below the Cover Systems when fixed stations are used, verification VOC samples will be collected once per week at two air-monitoring stations. The verification samples are collected to demonstrate that the real-time monitoring stations are effective in measuring the concentration of the VOC target compounds. VOC samples will be collected using 6-liter Summa® canisters (or equivalent vacuum canisters) and analyzed using United States Environmental Protection Agency (USEPA) Method TO-15 modified to include naphthalene. An accredited laboratory will perform the analytical testing on the canisters and will provide Category B deliverables as required by the New York Analytical Services Protocol. The data will be validated in accordance with the USEPA Contract Laboratory Program (CLP) National Functional Guidelines for Organic Data Review, EPA 540/R-99/008 (October 1999) and the USEPA Region II Functional Guidelines for Evaluating Organic Analyses (September 2006), modified as necessary to accommodate the non-CLP methodologies used.

2.4 Pre-Construction Baseline Sampling

For significant excavation below the Cover Systems, pre-construction sampling will be completed to establish baseline ambient air concentrations prior to the start of excavation activities. Baseline conditions will be developed for TVOC and PM-10 in ambient air when real-time fixed station sampling methods are used. Sample collection and analysis methods will follow those described in subsection 2.2.1. Pre-construction real-time sampling will take place at the fixed air monitoring station locations to determine TVOC and PM-10 baseline conditions. TVOC and PM-10 data will be recorded 24 hours per day for a minimum of three days.

2.5 Data Management Procedures

This section of the Plan discusses the data management procedures that will be used during the remedy. Data may be generated from a variety of sources, including real-time fixed station analytical monitoring, supplemental walk-around monitoring, tripod-mounted monitoring stations, and meteorological monitoring.

These data must be reduced, evaluated, verified, and presented to related parties in a timely manner to facilitate decision-making. The data management process for each source of data is discussed below.

The Consultant will review all real-time data in a timely manner following collection and transmit the final summary report to National Grid.

2.5.1 Fixed Station Monitoring

Analytical data generated at each fixed-station are sent to the central computer system via radio telemetry or will be manually downloaded daily. The monitoring data will also be downloaded to the project database for data evaluation. The following daily charts or tables will be prepared:

- Instantaneous and averaged TVOC concentrations compared to the TVOC Action Level
- Instantaneous and averaged PM-10 concentrations compared to the PM-10 Action Level
- Supplemental Perimeter Walk-Around PM-10 concentrations compared to the Action Level (if any)
- Supplemental Perimeter Walk-Around TVOC concentrations compared to the TVOC Action Level (if any)
- Air monitoring station locations

The following weekly charts or tables will be prepared:

- Meteorological conditions
- Maximum 15-minute average concentrations of TVOC and PM-10
- Upwind and downwind comparison of Response Level and Action Levels reached during the week
- Summary of site activities
- Air monitoring station locations

2.5.2 Tripod Mounted/Supplemental Perimeter Walk-around Monitoring

Analytical data generated at each tripod mounted station and from any supplemental perimeter walk-around monitoring will be manually downloaded daily for data evaluation. The following daily table(s) will be prepared:

- Daily maximum instantaneous and averaged TVOC concentrations compared to the TVOC Action Level
- Daily maximum instantaneous and averaged PM-10 concentrations compared to the PM-10 Action Level
- Supplemental Perimeter Walk-Around PM-10 concentrations compared to the Action Level (if any)

- Supplemental Perimeter Walk-Around TVOC concentrations compared to the TVOC Action Level (if any)
- Air monitoring station locations

The following weekly table(s) will be prepared:

- Maximum 15-minute average concentrations of TVOC and PM-10
- Upwind and downwind comparison of Response Level and Action Levels reached during the week if the daily maximum 15-minute average concentrations of TVOC and PM-10 exceeded a Response Level or Action Levels
- Summary of site activities
- Air monitoring station locations

3. Alert Responses

The purpose of this section is to identify the procedures to be followed in response to elevated levels of target compounds measured during intrusive activities below the Cover Systems. Response actions will be enacted by the Contractor, CM, and National Grid. The Consultant will report any occurrences where a Response Level or Action Level is exceeded, which would require response measures to be enacted. The NYSDEC will be notified of any occurrence where an Action Level (NYSDOH threshold) is exceeded. If there is a verified exceedance, the Consultant will inform the CM, National Grid, and NYSDEC within 60 minutes of the exceedance via e-mail at a minimum. In general, a tiered approach to site conditions with corresponding response actions will be implemented during the air monitoring program. The four tiers of site conditions are defined as follows.

- **Site Condition 1.** Normal or ambient air-conditions where all target concentrations are less than the Alert Level for TVOC and the Response Levels for respirable particulate matter
- **Preliminary Site Condition 2.** Concentration of TVOC only is equal to or greater than the Alert Level, but less than the Response Level.
- **Site Condition 2.** Concentration of at least one target is equal to or greater than Response Level, but less than the Action Level.
- **Site Condition 3.** Concentration of at least one target is equal to or greater than the Action Level.

The response plan will rely on real-time data generated from the fixed-station monitoring, portable equipment monitoring, and meteorological monitoring. These data sources will be evaluated together in order to make appropriate decisions concerning site conditions and potential control measures.

An explanation of the notification system, specific conditions, and response actions for TVOC and PM-10 is presented below.

3.1 Total Volatile Organic Compounds

TVOC concentrations in air will be measured and recorded by station monitors. Figure 5 presents the TVOC decision diagram that will be used to determine the appropriate site condition based on contaminant concentrations.

Specific TVOC target concentrations for Site Condition 1, Preliminary Site Condition 2, Site Condition 2, and Site Condition 3 are summarized in Table 1.

3.1.1 Site Condition 1

Site Condition 1 will be in effect when the TVOC concentration is less than the Alert Level (3.7 ppm). Under a Site Condition 1, each organic vapor analyzer located at the monitoring stations will collect and analyze a TVOC sample at a frequency of one sample per minute.

3.1.2 Preliminary Site Condition 2

Preliminary Site Condition 2 will be in effect if the TVOC concentration measured at a station is greater than or equal to the Alert Level (3.7 ppm) but less than the Response Level (5.0 ppm). The Consultant will notify the Contractor, CM, and National Grid of elevated measurements and a Preliminary Site Condition 2.

At this time, the upwind and downwind concentrations will be compared to determine if the Preliminary Site Condition 2 is due to site activities. If downwind TVOC concentrations are greater than upwind concentrations, then it will be assumed that the Preliminary Site Condition 2 is due to site activities.

If the above condition is true, then a Preliminary Site Condition 2 will be verified. Under a verified Preliminary Site Condition 2, a contingency meeting will be held and attended by the Consultant, the Contractor, CM, and National Grid. The Contractor, CM, and National Grid will determine appropriate response actions. This meeting will be held within 60 minutes of the Preliminary Site Condition 2 verification. Possible Preliminary Site Condition 2 response actions are listed in Table 2. The site will remain in Preliminary Site Condition 2 as long as the TVOC concentration is between 3.7 ppm (Alert Level) and 5.0 ppm (Response Level), based on 15-minute averages.

The site will return to Site Condition 1 if the following condition is true.

- The 15-minute average concentrations for TVOC at each of the monitoring stations are less than 3.7 ppm (Alert Level).

3.1.3 Site Condition 2

Site Condition 2 will be in effect if average TVOC concentrations increase to greater than the Response Level of 5.0 ppm. Site Condition 2 will remain in effect if one of the following conditions is true.

- The average TVOC concentration, measured over a 15-minute period, is greater than or equal to 5.0 ppm (Response Level)

Under Site Condition 2, construction activities will be temporarily halted. A meeting attended by the Consultant, the Contractor, CM, National Grid, and NYSDEC, will be held within 60 minutes of the Site Condition 2. The Contractor, CM, National Grid, and NYSDEC will determine appropriate response actions. Possible Site Condition 2 corrective measures/actions are listed in Table 2. After appropriate corrective measures/actions are taken, work activities may resume provided that the TVOC concentration at the Site perimeter is no more than 5.0 ppm above background for the 15-minute average.

If average TVOC concentrations fall below the Response Level, then the site will be returned to Preliminary Site Condition 2, at which time work activities may resume. The Preliminary Site Condition 2 site condition will remain in effect as long as the following condition is true.

- The 15-minute average concentration for TVOC is greater than 3.7 ppm (Alert Level) and less than 5.0 ppm (Response Level).

The site will return to Site Condition 1 if the following condition is true.

- The 15-minute average concentrations for TVOC at each of the monitoring stations are less than 3.7 ppm (Alert Level).

3.1.4 Site Condition 3

Site Condition 3 will be in effect if average TVOC concentrations increase to greater than the Action Level of 25.0 ppm. Site Condition 3 will remain in effect if one of the following conditions is true.

- The average TVOC concentration, measured over a 15-minute period, is greater than 25 ppm (Action Level).

Under Site Condition 3, all construction activities will be halted. A meeting attended by the Consultant, the Contractor, CM, National Grid, and NYSDEC, will be held within 60 minutes of the Response Level notification. The Contractor, CM, National Grid, and NYSDEC will determine appropriate response actions. Possible Site Condition 3

corrective measures/actions are listed in Table 2. After appropriate corrective measures/actions are taken, work activities may resume provided that the TVOC concentration at the Site perimeter is no more than 5.0 ppm above background for the 15-minute average.

If average TVOC concentrations fall below the Action Level, then the site will be returned to a Site Condition 2. If average TVOC concentrations fall below the Response Level, then the site will be returned to Preliminary Site Condition 2, at which time work activities may resume. The Preliminary Site Condition 2 site condition will remain in effect as long as the following condition is true.

- The 15-minute average concentration for TVOC is greater than 3.7 ppm (Alert Level) and less than 5.0 ppm (Response Level).

The site will return to Site Condition 1 if the following condition is true.

- The 15-minute average concentrations for TVOC at each of the monitoring stations are less than 3.7 ppm (Alert Level).

3.2 Respirable Particulate Matter

PM-10 concentration in air will be measured and recorded by the station monitors and may be temporarily suspended during periods of rain. Figure 6 presents the PM-10 decision diagram.

Specific PM-10 target concentrations for Site Condition 1, Preliminary Site Condition 2, Site Condition 2, and Site Condition 3 are summarized in Table 1.

3.2.1 Site Condition 1

Site Condition 1 will be in effect when the downwind 15-minute average PM-10 concentration is less than 100 $\mu g/m^3$ above the current average upwind conditions (Response Level).

3.2.2 Site Condition 2

Site Condition 2 will be in effect if the average 15-minute PM-10 concentration at a station is greater than 100 $\mu g/m^3$ (Response Level), less than 150 $\mu g/m^3$ (Action Level), and related to site activities. The Consultant will notify the Contractor, CM, National Grid, and NYSDEC of elevated measurements and a possible Site Condition 2. The upwind and downwind PM-10 concentrations will be compared to determine if the elevated PM-10 concentrations are due to site activities. If downwind PM-10

concentrations are 100 $\mu g/m^3$greater than upwind concentrations (Response Level), then it will be assumed that the Site Condition 2 is due to site activities.

The Site Condition 2 will remain in effect as long as the average PM-10 concentration is greater than or equal to 100 $\mu g/m^3$ above upwind conditions (Response Level), and less than or equal to 150 $\mu g/m^3$(Action Level). Under a verified Site Condition 2, dust suppression techniques must be implemented by the Contractor and/or National Grid contractors. At this point, routine monitoring continues and 15-minute averages continue to be evaluated. Work may continue with dust suppression techniques provided that downwind PM-10 levels do not exceed 150 $\mu g/m^3$ above the upwind level (Action Level) and provided that no visible dust is migrating offsite from the work area.

A contingency meeting attended by the Consultant, the Contractor, CM, National Grid, and NYSDEC will be held within 60 minutes of the verified Site Condition 2 if the condition is not mitigated by dust suppression techniques. Possible response actions for dust control are listed in Table 2.

3.2.3 Site Condition 3

Site Condition 3 will be in effect if the average 15-minute PM-10 concentration exceeds 150 $\mu g/m^3$ above the current average upwind concentration (Action Level). Under Site Condition 3, work must be stopped and a meeting attended by the Consultant, the Contractor, CM, National Grid, and NYSDEC will be held within 60 minutes of the Response Level notification. The Contractor, CM, National Grid, and NYSDEC will determine appropriate response actions. Possible Site Condition 3 response actions for PM-10 are listed in Table 2. Work may resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

3.3 Visible Dust

In addition to measured PM-10 levels, the CAMP requires monitoring of visible dust conditions. If visible airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 levels do not exceed the Action Level concentration of 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

4. Reporting

The Consultant will prepare and submit weekly reports to the Contractor, CM, National Grid, and NYSDEC summarizing the CAMP monitoring data. Each report will consist of a letter-style report and charts/tables summarizing the following:

- Maximum 15-minute average concentrations of TVOC, and PM-10
- Upwind and downwind comparison of Response Levels and Action Level reached during the weekly period
- Summary of site activities
- Air monitoring station locations
- Meteorological conditions

Following the completion of all work, a report will be developed summarizing the intrusive activities. As part of the report, the CAMP activities will be documented.

References

New York State Department of Environmental Conservation. 2010. DER-10 / Technical Guidance for Site Investigation and Remediation. Division of Environmental Remediation. May 3, 2010. Appendix 1A. pp. 204-206.

Tables

Table 1. Target Concentrations for Site Conditions
Community Air Monitoring Plan
Rockaway Park Former MGP Site
Interim Site Management Plan
Rockaway Park, New York

	Alert Level[1]	NYSDOH generic CAMP[2]		Site Condition 1	Preliminary Site Condition 2	Site Condition 2	Site Condition 3
		Response Level	Action Level				
TVOC	3.7 ppm	5.0 ppm	25 ppm	< 3.7 ppm	≥ 3.7 ppm	≥ 3.7 ppm, < 5.0 ppm	≥ 5.0 ppm
PM-10	NA	100 ug/m^3	150 ug/m^3	< 100 ug/m^3	NA	≥ 100 ug/m^3, < 150 ug/m^3	≥ 150 ug/m^3

Notes:

[1] Alert Levels are not established by the NYSDOH or NYSDEC and are internally established concentration levels for total volatile organic compounds. Alert Levels are set below the levels established by the NYSDOH so that actions can be taken prior to exceeding a NYSDOH threshold. An Alert Level serves as a screening tool to trigger contingent measures if necessary, to assist in minimizing off-site transport of contaminants during remedial activities

[2] Response Levels and Action Levels are defined in Appendix 1A of the New York State Department of Environmental Conservation *DER-10 / Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010)

ug/m^3 - micrograms per cubic meter

ppmv - parts per million by volume

TVOC - total volatile organic compounds

PM-10 - particulate matter (i.e. dust) less than 10 microns in diameter

NA - not applicable

Table 2. Site Conditions and Response Actions
Community Air Monitoring Plan
Rockaway Park Former MGP Site
Interim Site Management Plan
Rockaway Park, New York

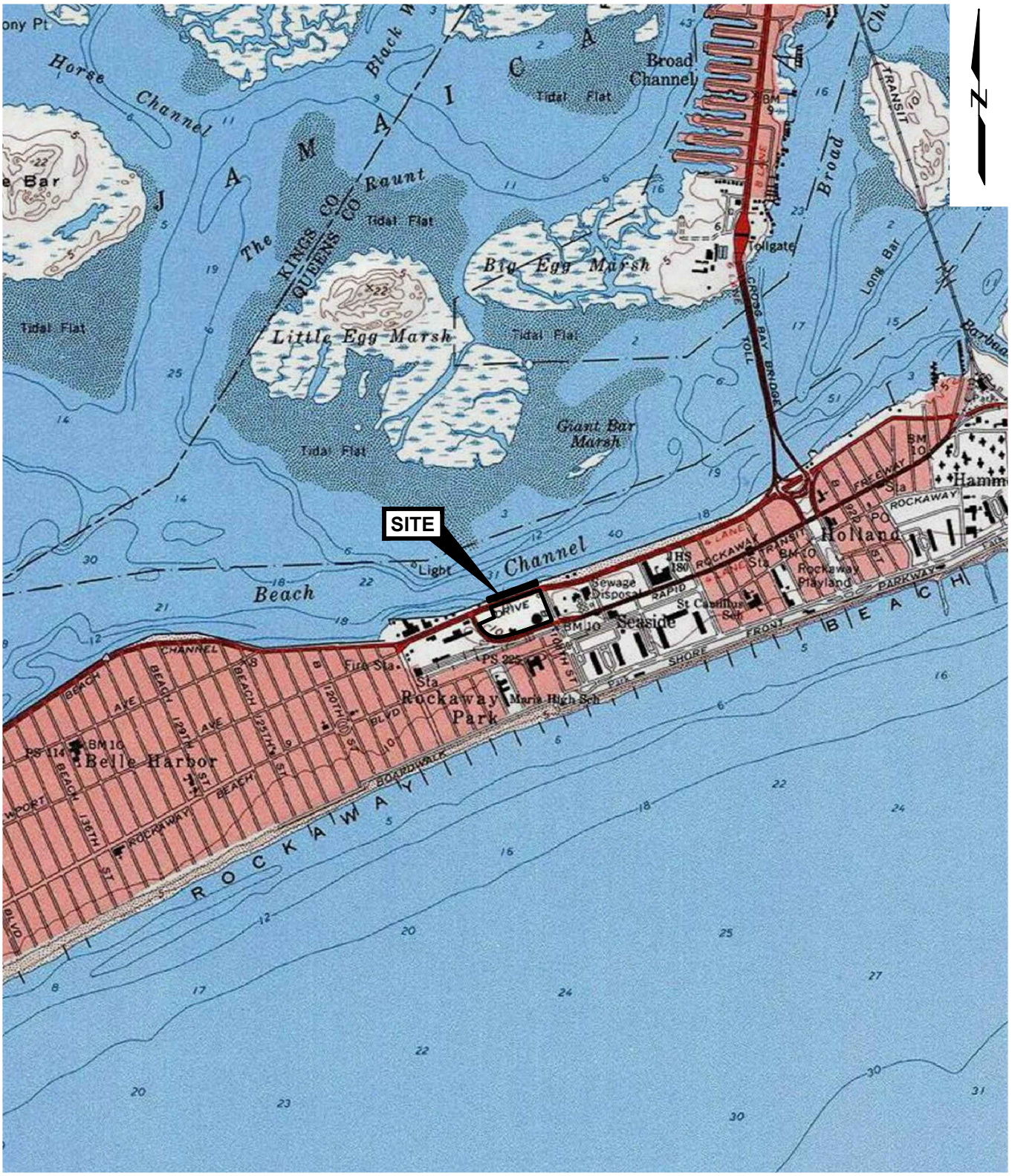
Site Condition	Control Measure
Site Condition 1	Normal site activities - No control measures required
Site Condition 2	Establish trend of data and determine if evaluation/wait period is warranted Temporarily stop work Temporarily relocate work to an area with potentially lower emission levels Apply water to area of activity or haul roads to minimize dust levels Reschedule work activities Cover all or part of the excavation area Apply VOC emission suppressant foam over open excavation areas Slow the pace of construction activities Change construction process or equipment that minimize air emissions Install a perimeter barrier fence Apply water on haul roads* Wet equipment and excavation faces* Spray water on buckets during excavation and dumping* Haul materials in properly tarped or watertight containers* Restrict vehicle speeds to 10 mph* Cover excavated areas and material after excavation ceases* Reduce the excavation size and/or number of excavations*
Site Condition 3	Halt work Encapsulate construction area and treat air exhaust Perform work during cold weather Cease construction activities Re-evaluate air monitoring work plan

Notes:

The control measures specified under each site condition can be implemented in any order that is most appropriate under the existing site conditions.

* control measures suggested in the New York State Department of Environmental Conservation *DER-10 / Technical Guidance for Site Investigation and Remediation* (NYSDEC, 2010)

Figures



SOURCE:

U.S.G.S 7.5 Minute Topographic Maps, accessed via ArcGIS for AutoCAD

©2013 National Geographic Society, i-cubed.

0 2000 4000

SCALE: 1" = 2000'

Community Air Monitoring Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

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SITE LOCATION FIGURE

Project 093150 | March 2017 | Fig. 1

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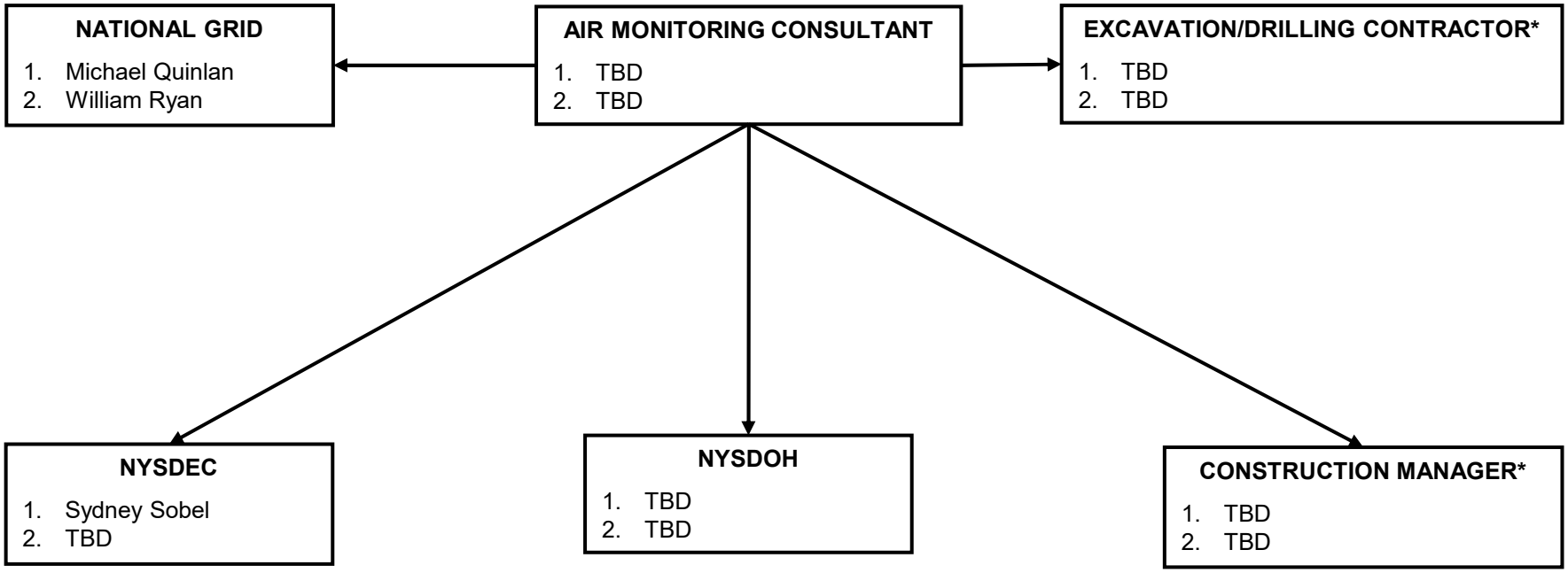

National Grid, Air Monitoring Consultant, Excavation/Drilling Contractor*, Construction Manager*, and NYS Representatives

Meet at the Field Office and/or Confer by Phone Within 60 Minutes of the Alert

If the primary contact is unavailable, contact alternatives in the order noted, or as shown on the contact list.

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NOTE:

TBD To Be Determined

* May not be applicable to all work completed at the site

COMMUNITY AIR MONITORING PLAN
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

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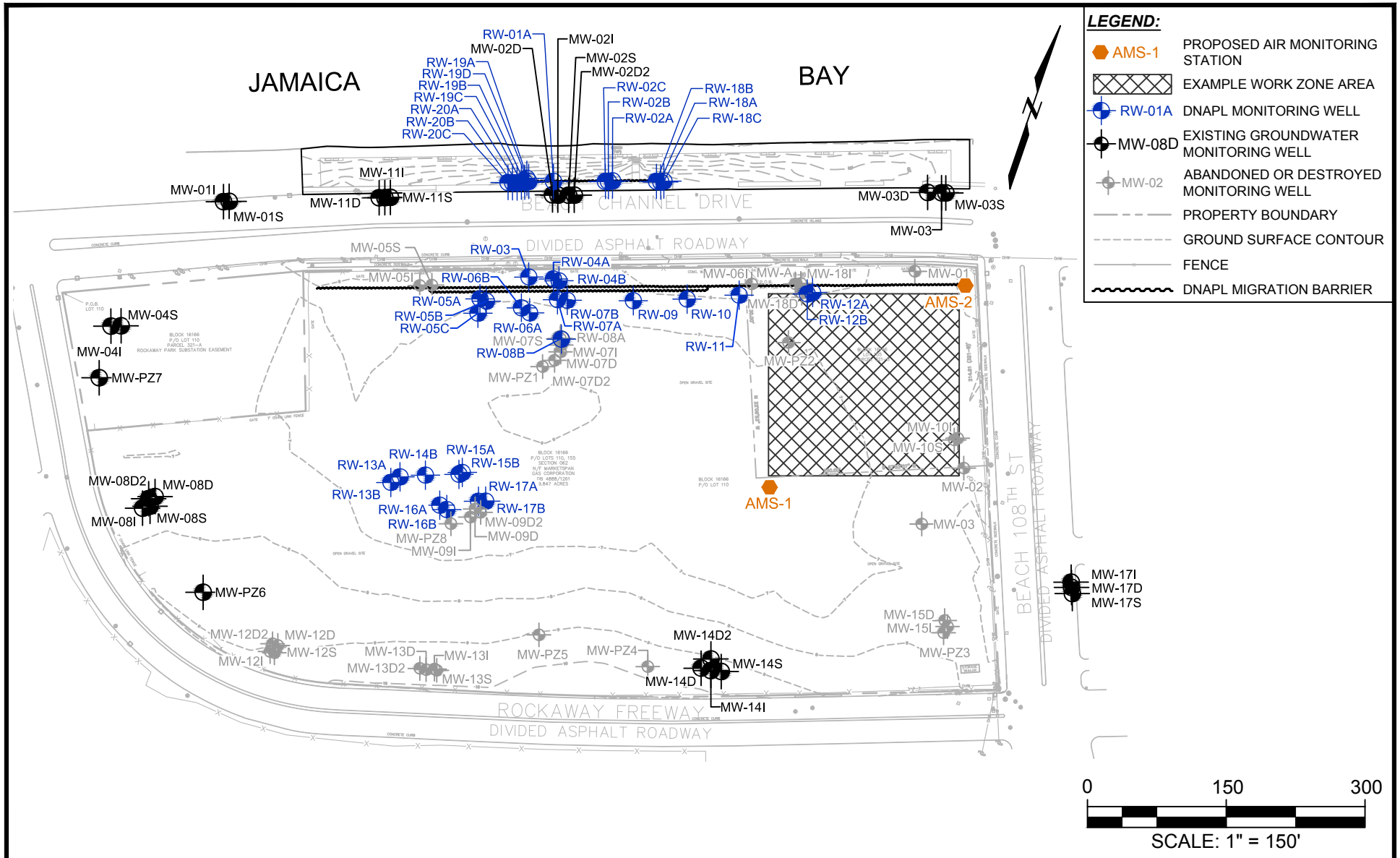
COMMUNICATION FLOWCHART

Project 093180 | March 2016 | Figure 2

H:\WPROC\Project\NationalGrid\Rockaway Park\SMP\2017-Mar-DEC-Draft\RockawaySMP CAMP Fig 2-6.ppt



SOURCE:
BOUNDARY SURVEY, SECTION 062 - BLOCK 16166 - LOTS 110 & 155, ROCKAWAY PARK, QUEENS COUNTY, NEW YORK, PREPARED BY KENNON SURVEYING SERVICES INC., SCALE: 1" = 40', DATE: NOVEMBER 2016.

Community Air Monitoring Plan
Rockaway Park Former MGP Site
Rockaway Park, New York

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AIR MONITORING STATION LOCATIONS

Project 093150 | March 2017 | Fig. 3

\\gtb1v-fs01\ I:\Project\National Grid\Rockaway Park\093150\Figures\CAMP\093150-CAMP-FIG.dwg - 3/13/2017

1. Solar Panel
2. DustTrak™ sample tubing with in-line condenser
3. DustTrak™ sample inlet with PM-10 impactor
4. Station enclosure
5. DustTrak™ Aerosol Monitor
6. PhotoVac™ 20/20 PID
7. PhotoVac™ 20/20 PID sample inlet
8. PhotoVac™ 20/20 PID sample inlet tubing
9. Data communications device

DRAFT

NOTE:
Figure depicts an AirLogics™, LLC Light air monitoring station as an example and may not be representative of the actual system or components that will be employed at the site

COMMUNITY AIR MONITORING PLAN
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

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EXAMPLE FIXED STATION INTERNAL COMPONENTS

Project 093180 | March 2017 | Figure 4A

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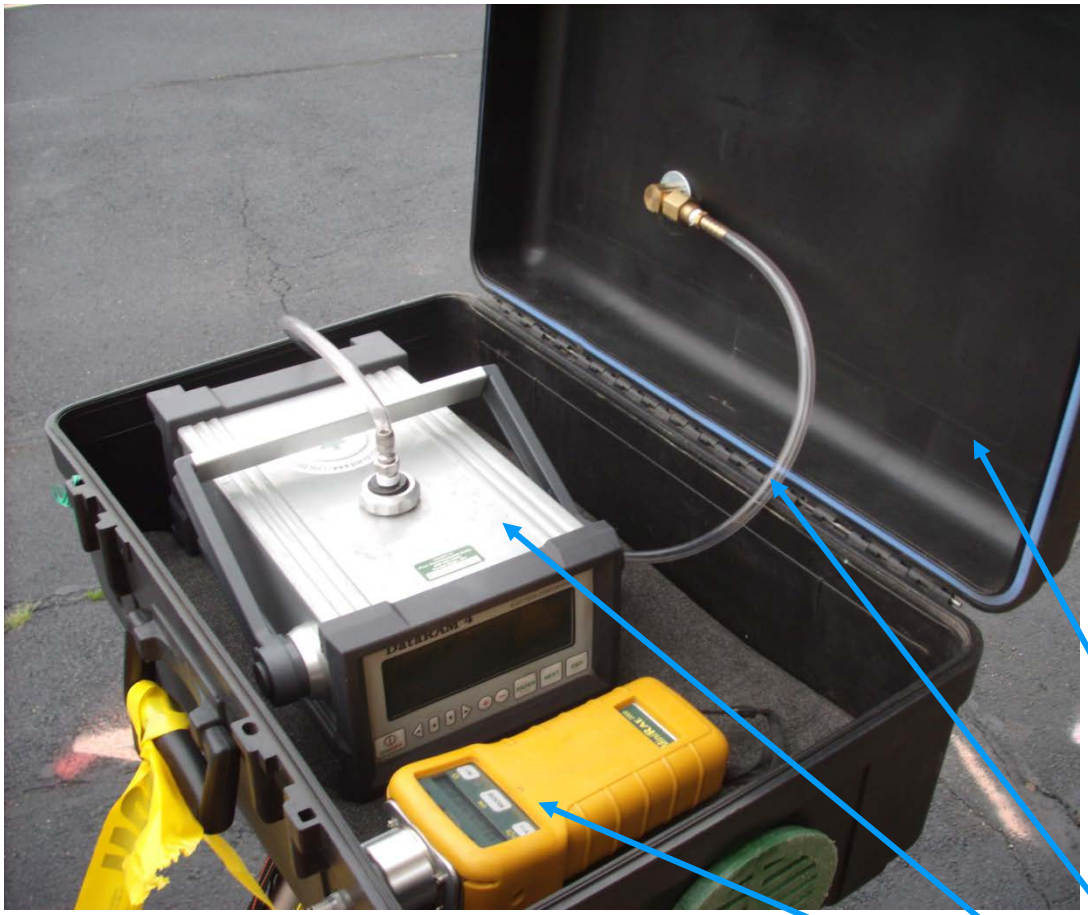

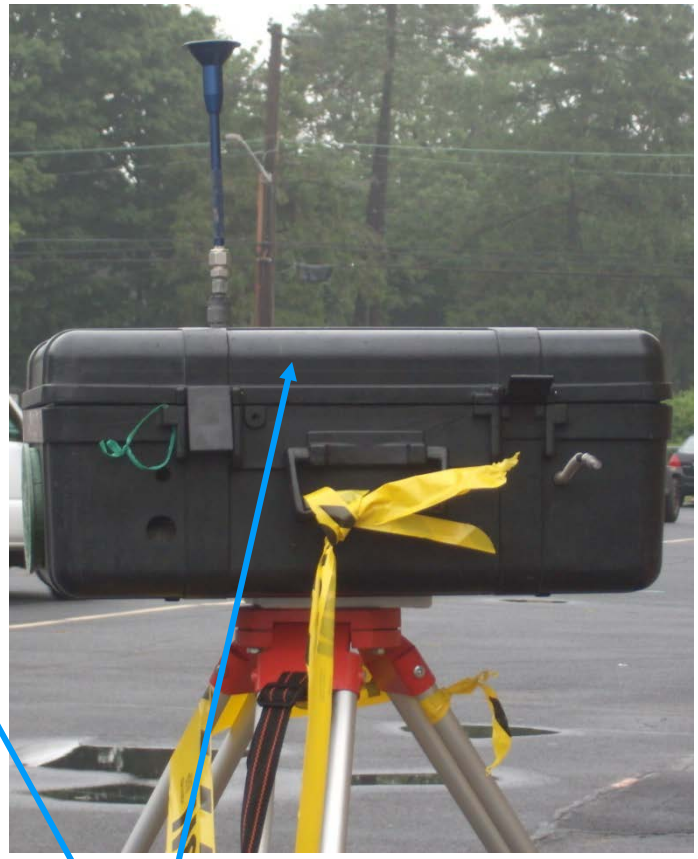

(1) (2) (3) (4)

1. MiniRAE 2000 PID Organic Vapor Anayzer (OVM)
2. DataRAM Particulate Monitor
3. DataRAM sample tubing
4. Station enclosure

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NOTE:
Figure depicts a Pine Environmental air monitoring station as an example and may not be representative of the actual system or components that will be employed at the site

COMMUNITY AIR MONITORING PLAN
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

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EXAMPLE TRIPOD MOUNTED STATION INTERNAL COMPONENTS

Project 093180 | March 2017 | Figure 4B

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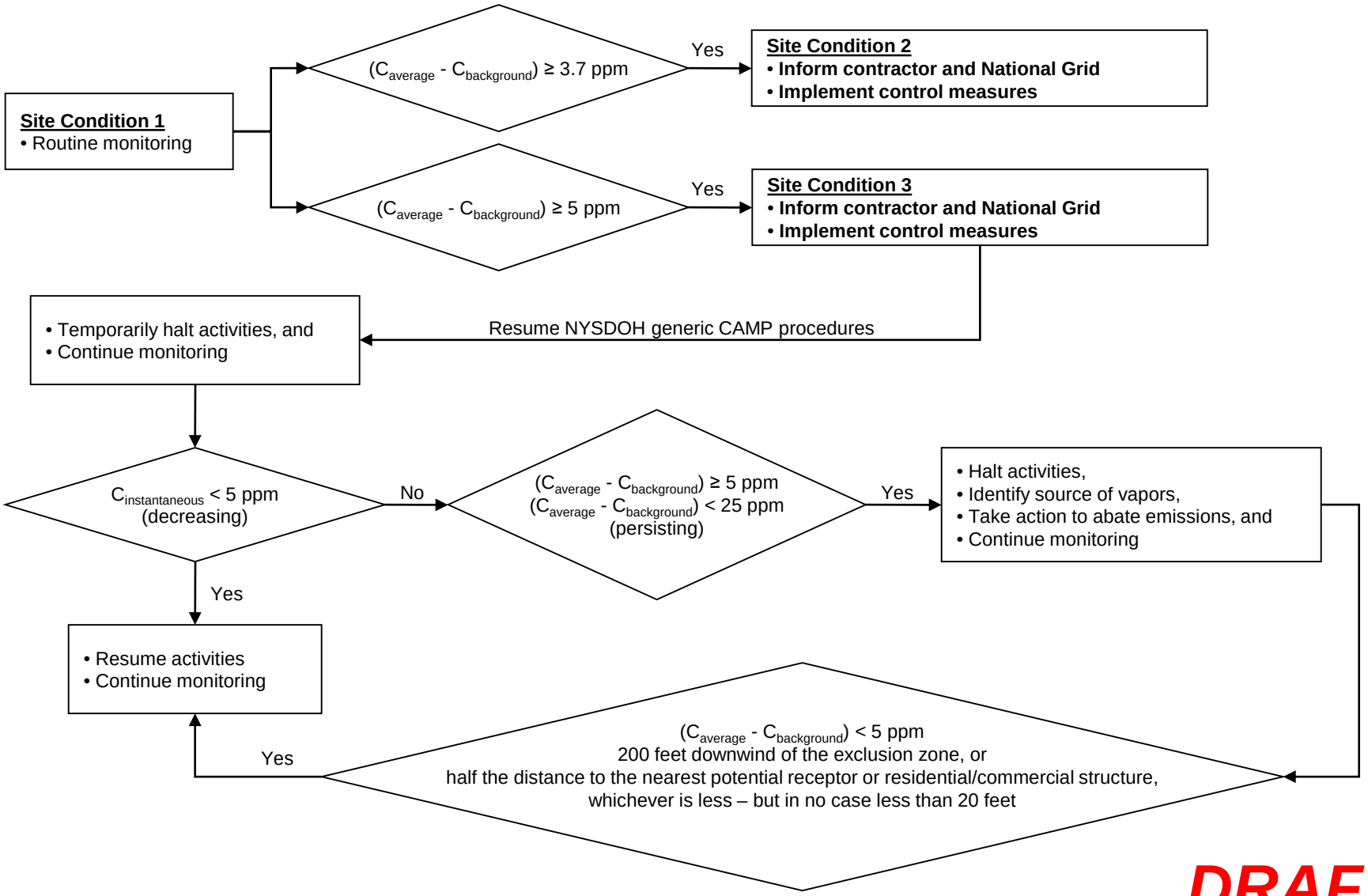

DRAFT

NOTES:

1. TVOC – Total Volatile Organic Compound
2. ppm – parts per million
3. $C_{average}$ = 15-minutes average concentration
4. $C_{background}$ = 15-minutes average concentration upwind
5. $C_{instantaneous}$ = 1-minute measured concentration

COMMUNITY AIR MONITORING PLAN
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

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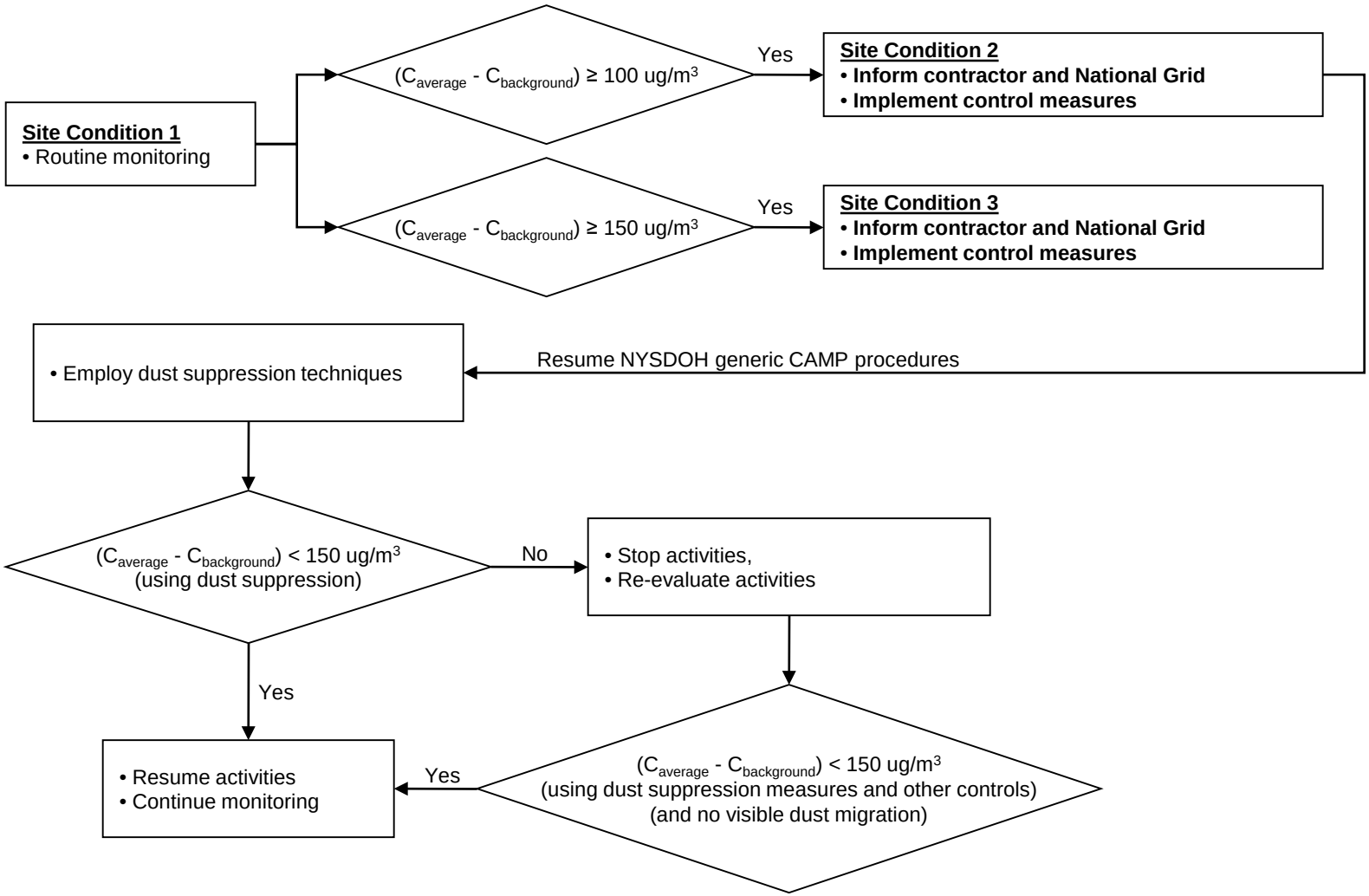
TVOC
DECISION DIAGRAM

Project 093180 | March 2017 | Figure 5

H:\WPROC\Project\NationalGrid\Rockaway Park\SMP\2017-Mar-DEC-Draft\RockawaySMP CAMP Fig 2-6.ppt



DRAFT

NOTES:

1. PM-10 – particulate matter
2. µg/m^3 – micrograms per cubic meter
3. $C_{average}$ = 15-minutes average concentration
4. $C_{background}$ = 15-minutes average concentration upwind
5. $C_{instantaneous}$ = 1-minute measured concentration

COMMUNITY AIR MONITORING PLAN
ROCKAWAY PARK FORMER MGP SITE
ROCKAWAY PARK, NEW YORK

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PARTICULATE MATTER DECISION DIAGRAM

Project 093180 | March 2017 | Figure 6

H:\WPROC\Project\NationalGrid\Rockaway Park\SMP\2017-Mar-DEC-Draft\RockawaySMP CAMP Fig 2-6.ppt

Appendix A

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or

overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

APPENDIX K
RESPONSIBILITIES of
SITE OWNER, REMEDIAL PARTY AND OFF-SITE OWNER

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the Rockaway Park former MGP Site (the "Site"), number 2-41-029, are divided between the National Grid (the Remedial Party) and the Off-Site Property owner, as defined below. The owner(s) is/are currently listed as:

Parcel Identification	Parcel Owner	Owner Address
Block 16166, Lot 155	National Grid	175 East Old Country Road, Hicksville, NY 11801
Block 16166, Lot 110	National Grid	175 East Old Country Road, Hicksville, NY 11801
Block 16166, Lot 177	NYCDPR	New York City Department of Parks & Recreation, The Arsenal, Central Park, 830 Fifth Avenue, New York, NY 10065

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is National Grid, 175 East Old Country Road, Hicksville, NY 11801.

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.

On-Site Property Owner's Responsibilities (Remedial Party - National Grid):

1) National Grid shall follow the provisions of the SMP as they relate to future construction excavation, and development at the Site.

2) In accordance with a periodic timeframe determined by the NYSDEC, National Grid shall periodically certify, in writing, that all Institutional Controls set forth in an Environmental Easement remain in place and continue to be complied with.

3) In the event the Site is delisted, National Grid remains bound by the Environmental Easement and shall submit, upon request by the NYSDEC, a written certification that the Environmental Easement is still in place and has been complied with.

4) National Grid shall grant access to the Site to the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) National Grid is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, National Grid shall notify the NYSDEC in accordance with the timeframes indicated in Section 1.3-Notifications.

6) In the event some action or inaction by National Grid adversely impacts the Site, National Grid must notify the NYSDEC in accordance with the time frame indicated in Section 1.3- Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7) National Grid must notify the NYSDEC of any change in ownership of the Site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Site properties. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) National Grid shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting at the Site. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.

9) Before accessing the Off-Site Property to undertake a specific activity, National Grid shall provide the owner advance notification that shall include an explanation of the work expected to be completed. National Grid shall provide to (i) the Off-Site Property owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if required by the SMP, a copy of any data generated during the Site/off-site property visit and/or any final report produced.

10) If the NYSDEC determines that an update of the SMP is necessary, National Grid shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, National Grid shall submit a copy of the approved SMP to the Off-Site Property owner.

11) National Grid shall notify the NYSDEC and the Off-Site Property owner of any changes in National Grid ownership and/or control and of any changes in the party/entity responsible for the operation, maintenance, and monitoring of and reporting with respect to any remedial system (Engineering Controls). National Grid shall provide contact information for the new party/entity. Such activity constitutes a Change of Use pursuant to 375-1.11(d) and requires 60-days prior notice to the NYSDEC. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html .

12) National Grid shall notify the NYSDEC of any known damage to or modification of the systems as required under Section 1.3- Notifications of the SMP.

13) Any change in use, change in ownership, change in On-Site Property/Off-Site Property classification (*e.g.*, delisting), reduction or expansion of remediation, and other significant changes related to the On-Site Property/Off-Site Property may result in a change in responsibilities and, therefore, necessitate an update to the SMP and/or updated legal documents. National Grid shall contact the Department to discuss the need to update such documents.

Off-Site Property Owner's Responsibilities (NYCDPR):

1) The owner of the Off-Site Property will be responsible to notify the National Grid within the established time frames documented in this SMP of plans for the performance of invasive activities in areas of the Off-Site Property that may encounter known or potential soils and/or groundwater with MGP-related impacts.

2) The owner of the Off-Site Property shall grant access to the Off-Site Property to the National Grid and its agents for the purposes of performing activities required under the SMP, including groundwater monitoring activities, and assuring compliance with the SMP.

2) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components, the owner shall notify National Grid in accordance with the timeframes indicated in Section 1.3.1 - Notifications.

3) In the event some action or inaction by the owner adversely impacts the remedial components, the owner must notify the National Grid in accordance with the time frames indicated in Section 1.3.1 - Notifications and (ii) coordinate the performance of necessary corrective actions with National Grid.

4) The owner must notify National Grid of any change in ownership of the Off-Site Property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the Off-Site Property. 5) The owner shall provide sixty days' prior notice of a proposed change in use to the NYSDEC and National Grid. Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, National Grid shall submit to the NYSDEC for approval of an amended SMP.

Change in National Grid ownership and/or control and/or On-Site Property/Off-Site Property ownership does not affect National Grid's obligations with respect to the On-Site Property/Off-Site Property unless a legally binding document executed by the NYSDEC releases National Grid of its obligations.

Future On-Site Property/Off-Site Property owners and National Grid and their successors and assigns are required to carry out the activities set forth above.