GEI Consultants

Geotechnical
Environmental
Water Resources
Ecological

Remedial Action Plan

Glen Cove Former Manufactured Gas Plant

Glen Cove, Town of Oyster Bay
Nassau County, New York
Order on Consent Index No. D1-001-98-11
Site No. 1-30-089P

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Abbreviations and Acronyms

ACO	Administrative Consent Order
AWQS	Ambient Water Quality Standards
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
BUG	Brooklyn Union Gas
bgs	Below ground surface
CAMP	Community Air-Monitoring Plan
CERCLA	Comprehensive Environmental Response Compensation and Liabilites Act
COCs	Contaminants Of Concern
COPC	Chemicals of Potential Concern
COPEC	Chemicals of Potential Ecological Concern
DNAPL	Dense Non-Aqueous Phase Liquid
ELUR	Environmental Land Use Restriction
GEI	GEI Consultants, Inc.
HASP	Health and Safety Plan
IC/EC	Institutional Controls and Engineering Controls
ISBS	In-Situ Biogeotechnical Stabilization
LILCO	Long Island Lighting Company
LIPA	Long Island Power Authority
LIRR	Long Island Railroad
LNAPL	Light Non-Aqueous Phase Liquid
MGP	Manufactured Gas Plant
MNA	Monitored Natural Attenuation
NAPL	Non-aqueous Phase Liquids
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OSHA	Occupational Safety & Health Administration
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PEL	Permissable Exposure Limits
POTW	Publicly Owned Treatment Works
PS&S	Paulus, Sokolowski and Sartor Engineering PC
PVC	Polyvinyl chloride
QHHEA	Qualitative Human Health Exposure Assessment
QAPP	Quality Assurance Project Plan
RAA	Remedial Alternatives Analysis
RAP	Remedial Action Plan
RAO	Remedial Action Objectives
RDWP	Remedial Design Work Plan
RI	Remedial Investigation
RIR	Remedial Investigation Report

RSCO	Recommended Soil Clean-up Objectives
ROW	Right of Way
SARA	Superfund Amendments and Reauthorization Act of 1986
SCGs	Standards, Criteria, and Guidance
SCOs	Soil Clean-up Objectives
SMP	Site Management Plan
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TAGM	Technical and Administrative Guidance Memorandum
TOGS	Technical and Operational Guidance Series
VCA	Voluntary Cleanup Agreement
VOC	Volatile Organic Compound

Executive Summary

National Grid entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) to investigate and remediate contamination at the Glen Cove Former Manufactured Gas Plant (MGP) site (the Site), located in Glen Cove, Town of Oyster Bay, Nassau County, New York. The Site was owned and/or operated by a National Grid predecessor company from 1905 to 1927. It is currently occupied by an active electric system substation, owned by the Long Island Power Authority (LIPA). A series of site investigations were conducted between 1995 and 2008 to determine the environmental conditions at the Site. The NYSDEC-approved Final Remedial Investigation Report summarized these investigations and identified the presence of MGP-related impacts to subsurface soils and groundwater. This Remedial Action Plan (RAP) presents four remedial alternatives to address the MGP-related impacts located at the Site and recommends one of those alternatives as the proposed remedy.

The Site is located in a flat depression bounded by approximately 20-foot high slopes to the north, south, and east. Vehicle access to the Site is limited to a one-lane, steeply-graded access road from Grove Street from a residential neighborhood terminating in a flat, level area in the center of the Site. The active LIPA substation, located on the flat portion of the Site, is an important component of the utility's infrastructure. The substation supplies electricity to an area that encompasses a major portion of the City of Glen Cove. LIPA is planning to upgrade this substation to meet the growing electrical energy demand in the City of Glen Cove area. There are two near by substations; however, the capacity of the existing circuits between the neighboring substations will not be able to supply the entire electrical load of the City of Glen Cove area; therefore, the substation cannot be taken out of service to accommodate complete removal of all impacted materials. This restriction and the physical setting of the Site limit the remedial alternatives and technologies that can be used at the Site.

The recommended remedy for the Site is Remedial Alternative 3. Alternative 3 achieves the Remedial Action Objectives for the Site through a combination of shallow "hotspot" removal of MGP-related material, groundwater treatment via oxygen injection, non-aqueous phase liquid (NAPL) recovery, monitored natural attenuation and institutional controls. Removing shallow accessible MGP-related source material will reduce the ongoing contaminant mass flux into the groundwater. NAPL recovery will also reduce the contaminant mass. The oxygen injection system will then treat the residual groundwater plume prior to its migrating off site and enhance the natural attenuation process observed on site and downgradient during the Remedial Investigation.

This alternative will not immediately return the Site to pre-release conditions (Alternative 4). However, completion of Alternative 3 will eventually achieve similar results as complete removal without the risk of interrupting electrical service, at substantially less the disruption to the community required to return the Site to pre-release conditions. Furthermore, implementing Alternative 3 will eliminate and control exposure pathways to site contaminants as effectively as would Alternative 4. Any additional removal potentially achieved through Alternative 4 will not create a condition that is substantially more protective of human health and the environment. Returning the Site to pre-release conditions would require demolition of the important LIPA substation, extensive construction dewatering activities, and substantive excavation support structures. These activities would create serious disruptions to the community as well as the risk of a loss of electrical service to a broader area. In addition, it would be a more costly alternative, with as noted, no incremental improvement in environmental health and safety.

Alternative 3 will include the development and implementation of a Site Management Plan (SMP). The SMP will identify the institutional controls and engineering controls (IC/ECs) required to maintain the remedial alternative and manage potential risks related to possible future site activities or property development. The IC/ECs are required to prevent and control potential exposure to remaining contaminants related to the exposure of subsurface materials due to excavation activities during and after implementation of the recommended alternative. The institutional control in the form of a deed restriction will limit the use of the site to commercial or industrial use.

As stated above, the current property owner, LIPA, is planning to conduct a facility upgrade beginning in September 2010. The upgrade will include the installation of underground utilities and foundations. LIPA has requested that the hot spot excavation activities be performed prior to the upgrade. Once the new facilities are in place, excavation in these areas will be restricted. Therefore, National Grid requests approval to perform the excavation of the hot spots as an Interim Remedial Measure (IRM) in advance of the formal remedy approval. LIPA has emphasized that they will not permit remedial work during the summer of 2010 as this is the period when the need for optimal substation operation is the most critical. Therefore, this proposed IRM will be conducted during spring of 2010 and completed prior to the facility upgrade work. The planned substation upgrade affects only the timing of the excavation portion of the remedy and not the extent of the proposed excavation.

1. Introduction and Scope

National Grid has entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) to investigate and remediate potential contamination at a number of former manufactured gas plant (MGP) properties in New York. One of these properties is known as the Glen Cove Former Manufactured Gas Plant (MGP) site (the Site) located in Glen Cove, Town of Oyster Bay, Nassau County, New York **(Figure 1-1)**. The Site was owned and/or operated by a National Grid predecessor company from 1905 to 1927. It is currently occupied by an active electric system substation, owned by the Long Island Power Authority (LIPA). A series of site investigations were conducted between 1995 and 2008 to determine the environmental conditions at the Site. The NYSDEC-approved Final Remedial Investigation Report (RIR), dated November 14, 2008, summarized these previous investigations and identified the presence of MGP-related impacts to subsurface soils and groundwater. This Remedial Action Plan (RAP) presents four remedial alternatives to address the MGP related impacts located at the Site and recommends one of those alternatives as the proposed remedy.

This RAP has been developed in accordance with the requirements set forth in Title 6 of the New York Code of Rules and Regulations Part 375 for remedial action selection, and NYSDEC *Draft DER-10 Technical Guidance for Site Investigation and Remediation* (Draft DER-10) dated December 2002, and the VCA, Index No. D1-0001-98-11 signed by KeySpan Corporation (KeySpan), a predecessor company of National Grid, and the NYSDEC.

1.1 Applicable Regulations

The RIR was prepared in accordance with the December 2002 *NYSDEC Draft DER-10* guidance document that was developed to interpret the regulations in Title 6 of the New York Code of Rules and Regulations, Part 375. In accordance with guidance in DER-10, the Recommended Soil Cleanup Objectives (RSCO) identified in *NYSDEC Technical and Administrative Guidance Memorandum #4046* (TAGM 4046) were used in evaluating soil chemistry and the Ambient Water Quality Standards, Guidance Values, and Groundwater Effluent Limitations (AWQS) identified in *NYSDEC Technical and Operational Guidance Series 1.1.1* (TOGS) were used in evaluating groundwater chemistry.

In December 2006, Title 6 of the New York Codes, Rules and Regulations, Part 375 Environmental Remediation Programs (6 NYCRR Part 375) was revised. This included revised soil cleanup objectives, and the refinement of the interpretation of the presence of a “significant threat” to human health and the environment. As directed by the NYSDEC, consistent with the Remedial Investigation (RI) efforts beginning in 2003, soil chemistry was evaluated using TAGM 4046 guidance throughout the RI completion in 2008. However, this RAP has been developed to meet the current requirements of 6 NYCRR Part 375. The discussion of the RI in this document provides a transition to the revised regulations.

This document summarizes the RI findings and potential human health and environmental impacts identified at the Site; defines Remedial Goals, Remedial Action Objectives and Standards, Criteria and Guidance; evaluates remedial options and presents a recommended remedy. The balance of the document is divided into the following sections:

2. Site Description and History
3. Summary of Remedial Investigations
4. Remedial Action Objectives
5. General Response Actions
6. Identification and Screening of Technologies
7. Development and Analysis of Alternatives
8. Recommended Remedy

2. Site Description and History

2.1 Site Description

The Glen Cove Former MGP site is an inverted L-shaped parcel of approximately 1.9 acres presently occupied by an active electrical substation (**Figure 2-1**) which services Glen Cove and the surrounding area. Topographically, the Site is a flat depression bounded by approximately 20-foot high slopes to the north, south and east. To the west, the property slopes downward about 17 feet to Glen Cove Creek, a channelized stream, which eventually discharges to Hempstead Bay. The Site is bordered by a health club parking area to the north, with the Long Island Railroad (LIRR) tracks to the northwest, mixed commercial/ residential properties to the south and east; and Glen Cove Arterial Highway (Route 107) right-of-way (ROW) to the west. Glen Cove Creek flows in a general south to north direction along the western property line. It approaches the property via a culvert that passes beneath Route 107 and flows along the property line in an open channelized section. The creek leaves the property boundary at the northwest corner of the Site through a box culvert that directs flow beneath the LIRR tracks. The creek eventually discharges to Mosquito Cove (Hempstead Bay).

The Site is located in a flat depression bounded by approximately 20-foot high slopes to the north, south, and east. Vehicle access to the Site is limited to a one-lane steeply-graded access road from Grove Street from a residential neighborhood terminating a level, flat area in the center of the Site. The active LIPA substation, located on the flat portion of the Site, is an important component of the utility's infrastructure. The substation is fenced, as is access to the wooded western portion of the Site, and access from Grove Street. An easement runs along the north boundary of the property parallel to the health club property terminating to the east at Cedar Swamp Road.

2.2 Site History

MGP operations at the Site began in 1905 under the ownership of the Sea Cliff and Glen Cove Gas Company. The facility's footprint was relatively small and remained unchanged through its operational period, which ended in 1929. Facility structures were located on the northern section of the property, and consisted of a 60,000 cubic foot gas holder; boilers, purifiers, retorts, coal shed, engine room, tar and oil tank; and approximately eight gas tanks. In. 1923, Sea Cliff and Glen Cove Gas Company was purchased or merged with the Long Island Lighting Company (LILCO). A 40,000 cubic foot high pressure Hortonsphere gas holder was added to the facility in the southwestern portion of the Site in 1925 for gas distribution purposes.

In 1929, LILCO terminated MGP operations and demolished the facility's surface structures sometime thereafter. Site activities following 1929 consisted solely of natural gas storage in the Hortonsphere gas holder through the 1950s. The Hortonsphere was decommissioned and demolished between 1959 and 1966. A major electrical substation was constructed on the Site in the mid-1960s. In 1998, Brooklyn Union Gas (BUG) and LILCO merged to form the KeySpan Corporation, at which time the ownership of the substation was transferred to Long Island Power Authority (LIPA). In 2007, National Grid acquired responsibility for the former MGP property through the acquisition of KeySpan. Currently, the Site is owned by LIPA and operated by National Grid under contract to LIPA

The substation footprint is coincidental with the majority of the main operations area of the former MGP. High voltage transmission lines transverse the fenced substation area and the west and northwest sections of the Site both aerially and below grade (Figure 3).

Through the 2007 acquisition of KeySpan, National Grid has accepted responsibility for addressing the environmental issues at the Site. As such, National Grid will be referenced in the performance of all past and future work throughout the remainder of the document.

3. Summary of Remedial Investigations

The Final Remedial Investigation Report prepared by Paulus, Sokolowski and Sartor Engineering, PC (PS&S) was submitted by National Grid to the NYSDEC on November 14, 2008. The RI included the installation of soil borings, groundwater probes, monitoring wells and the sampling and analysis of soil, sediment, groundwater, surface water, and soil vapor. The results of the RI delineate the nature and extent of soil, creek sediment, groundwater and surface water impacts associated with the former MGP operations. Soil vapor was not determined to be a media of concern at this site; therefore, there is no further discussion of soil vapor nature and extent. The RI presented a compilation of the remedial and supplemental remedial investigations completed by PS&S and the findings of the following previously conducted site investigations:

- *Phase I Site Investigation Report For The Glen Cove Former Manufactured Gas Plant Site*, GEI Consultants, Inc./Atlantic Environmental Division, dated April 21, 1997
- *Due Diligence Investigation,* Dvirka and Bartilucci, dated February 16, 2000
- *Remedial Investigation – Preliminary Data Submittal and Proposed Additional Work Scope,* Paulus, Sokolowski and Sartor Engineering, PC, October 2004.

The following sections provide a summary of the findings of the RI and subsequent investigations. Additional details can be found in the 2004 RIR.

3.1 Site Geology

The shallow stratigraphy beneath the Site is considered heterogeneous fill and Upper Pleistocene deposits. The stratigraphic sequence consists of outwash deposits overlain by heterogeneous fill. The heterogeneous fill across most of the Site ranges in thickness from approximately 10 feet throughout most of the former site area to 30 feet in the off site area just north of the Site boundary. The fill composition is primarily poorly sorted and high permeability sand and gravel with varying percentages of gravel, silt, clay, and coal fragments. The glacial outwash deposits consist mainly of interbedded layers of permeable sand and gravel, and lower permeability silty sand. The top of the glacial unit was encountered from approximately 10 feet below ground surface (bgs) on the central portion of the Site to approximately 32 feet bgs from the top of the railroad embankment. The ground surface elevation of the Site is significantly lower than the top of the railroad embankment and, when factoring in the ground surface elevation difference, the glacial deposits are encountered at similar elevations across the Site and beneath the railroad embankment. The geologic formation at fences along the Site is presented in **Figure 3-1**.

Glen Cove Creek originally occupied a natural stream channel just to the west of the Site before it was channelized along its present alignment. The natural creek bed is indicated by the alluvial deposits consisting of reworked glacial outwash present along the western boundary of the Site. The alluvial deposits associated with the original stream channel consist of isolated sand and gravelly sand layers encountered in the upper 5 to 10 feet of soils at the western site boundary.

3.2 Site Hydrogeology

The groundwater beneath the Site is considered part of the regional Upper Glacial aquifer. Regionally, this aquifer is not used for drinking water. Drinking water for Long Island is provided by the deeper Magothy aquifer. The Upper Glacial aquifer occurs in the glacial outwash encountered beneath the Site. Outwash soils encountered during well installation were permeable sands and gravelly sands with little to no fines interbedded with lower permeability silty sands. These soil types are consistent with the Upper Glacial aquifer matrix description and the observed interbedding of permeable and lower permeability soil is consistent with the regional anisotropy (horizontal to vertical) of 10:1. The observed interbedding and resulting anisotropy significantly limits the rate of vertical flow and migration as compared to the horizontal direction.

Groundwater elevations of site wells were similar for the shallow and intermediate wells ranging from about 43 to 53 feet above mean sea level (feet-msl). In general, groundwater is encountered near the base of the fill layer at the Site. Groundwater elevation contours indicate a consistent groundwater flow direction to the west for the shallow zone wells (3 to 22 feet bgs) and the west-northwest for the intermediate zone (16 to 36 feet bgs). The potentiometric surface in the shallow groundwater follows the general topography of the Site sloping from east to west. The hydraulic gradient is relatively steep (0.06 feet/foot) in the eastern and western portions of the Site and less steep (0.02 feet/foot) in the central portion of the Site with an average gradient of 0.04 feet/foot. A uniform hydraulic gradient of about 0.01 feet/foot appears in the intermediate groundwater across the Site. The estimated groundwater seepage flow velocities, assuming an effective porosity of 20%, were calculated for the shallow and intermediate aquifer zones as 0.044 and 0.001 feet/day, respectively.

The potential vertical hydraulic gradient in the central portion of the Site indicated a downward potential vertical gradient. An upward potential vertical gradient was present along the Site’s western boundary. Wells installed off-site to the north of the Site showed variable potential vertical gradients likely due to recharge from rainfall events.

3.3 Nature and Extent of Chemical Constituents

A Conceptual Model of the Site is presented in **Figure 3-2**. The drawing presents a plan and cross section through the area of the former facility defining the horizontal and vertical extent of MGP-related visual impacts. The model also notes the approximate limits of MGP-related dissolved phase constituents. The MGP-impacted soils were most frequently observed in areas within or surrounding the former MGP operations, in the northwestern and western portions of the Site, and outside the Site limits to the north. The majority of the observations were at and below the water table. The water table on site is approximately 8-10 feet bgs based on the topography. The MGP-impacted soils included source materials and other MGP-impacted materials. Source material is defined in 6 NYCRR Part 375-1.2(au). For the purposes of this Site, source material consists of materials containing tar or oil-like materials, where individual droplets, pools, or stringers are visible to the naked eye. MGP-impacted materials is defined as materials which do not contain NAPL or product, but exhibit MGP-related sheens, staining, odors, or analytical sampling results which do not meet the Unrestricted Use SCOs for soils.

- Source material was encountered at 21 soil boring locations within the 8 to 30 foot bgs depth interval. The distribution of observed MGP impacts included tar/NAPL saturation at most of the 21 locations from the top of the water table to about 20 feet bgs.
- Thin lenses (0.5 feet or less) of tar/NAPL saturation were encountered deeper (22 and 27.8 feet bgs) at one soil boring. Blebs were often observed below the DNAPL/tar saturation at the same locations.
- Solid tar and staining were less prevalent than DNAPL/tar saturation/blebs in the 8 to 30 foot bgs depth interval.
- A total of eight soil boring locations within the greater than 30 foot bgs depth interval exhibited MGP-related visual impacts. DNAPL/tar saturation was observed as thin lenses (0.5 feet or less) at two soil boring locations.

Overall, the general sequence of MGP-related visual impacts begins at the water table as tar/NAPL saturation and blebs. The occurrence of these impacts reduces with depth. MGP-related visual impacts are negligible in the surface and vadose zone relative to the frequency of impacts observed at the water table and in the saturated zone.

3.4 Remedial Investigation Findings

Based on the findings of the previous site investigations, the RI program, and subsequent investigations, the following conclusions were reached in the RI:

- The shallow stratigraphy beneath the Site consists of approximately 10 to 30 feet of heterogeneous fill soil at the surface overlying Upper Pleistocene glacial deposits. The fill soils are underlain by glacial outwash deposits to the greatest depth investigated (82 feet). The outwash deposit soils consist of highly permeable sands and gravelly sands interbedded with lower-permeability silty sands that appear to have retarded the vertical migration of DNAPL at the Site.
- Groundwater beneath was generally encountered near the base of the fill soils at a depth of 8 feet below ground surface on the Site proper and is part of the regional Upper Glacial Aquifer. Groundwater flows in an east to west direction across the Site to Glen Cove Creek and eventually enters Glen Cove Creek as a non-point discharge.
- The areal extent of the visually apparent residual MGP-related impacts is limited to areas beneath or in the immediate vicinity of the former MGP operations in the northern and western portions of the Site and just beyond the Site limits to the north
- The vertical distribution of MGP-related visual impacts begins at the water table, at a depth of 8 feet as DNAPL/tar saturation and blebs, and their occurrence reduces with depth. The interbedded lower-permeability silty sand layers appear to have contributed to the limited vertical extent of DNAPL migration beneath the former MGP.
- The fill soils, which are predominately above the water table, are generally free of MGP residuals indicating that the fill was likely placed after removal of the MGP operation.
- Polycyclic aromatic hydrocarbons (PAHs) and metals are the identified constituents of concern in surface and near surface site soils. Based on the background surface soil study, the relatively elevated PAHs detected on site in surface/near surface soils suggests a potential contribution of PAH constituents from activities conducted on the former MGP site after or as part of placement of the surface fill soils. The source of the PAHs detected in soils at depths below the water table are associated with the MGP-related visual impacts, including DNAPL saturated and stained soil present at the same locations and depths. The background surface soil study indicated similar conditions between on-site and off-site surface soil regarding the detected metals (arsenic, barium, cadmium, chromium, lead and mercury). This indicates that concentrations noted on site are consistent with local conditions surrounding the Site and are not likely attributable to the activities on the former MGP site.
- DNAPL accumulation was noted in only one monitoring well, GCMW-13S, ranging in thickness from 0.34 to 0.74 feet. Based on the limited presence of measurable DNAPL in monitoring wells, there is a low potential for DNAPL migration at the Site.

- Benzene, toluene, ethylbenzene, and xylene (BTEX) and PAHs were detected in groundwater above the NYSDEC AWQS in the shallow and two intermediate zones beneath, and north and west of the former MGP operations area. BTEX and PAH groundwater concentrations are highest beneath the former MGP operation area and coincide with the observed source material.
- The dissolved phase BTEX and PAH impacts are limited in extent to the areas/depths exhibiting residual DNAPL in the soil and are not migrating at significant concentrations beyond the Site.
- The limited extent of downgradient migration of the dissolved phase BTEX/PAH plume appears to be the result of early removal of the former MGP operations and due to naturally occurring retardation and attenuation processes degrading the residual observed soil impacts. The fate and transport mechanisms apparent at the former Glen Cove MGP Site include sorption, aqueous solubility (or dissolution), volatilization and biodegradation. These natural processes in combination with the historical removal of the former MGP operations explain the observed limited extent of residual DNAPL impacts, and a relatively compact groundwater plume. These processes in combination with the ageing of the DNAPL source material and depletion of the soluble constituents will continue to prevent the observed on-site impacts from migrating beyond the existing plume limits. The dissolved phase BTEX and PAH plume emanating from the DNAPL impacts in groundwater will persist in the near future and eventually decrease in size and decline in concentration over the long term as MGP-related constituents dissolve and degrade.
- In groundwater, the metals exceeding the NYSDEC AWQS were either naturally-occurring or from infiltrating precipitation through the historic fill. PCBs and pesticides have not been released in the Site soils at significant levels and have not impacted the Site groundwater. The detected metals in groundwater are not migrating at significant concentrations beyond the Site.
- The analytical results of the seep water, surface water and sediment samples indicate the MGP-related impacts observed and detected on the former Glen Cove MGP site have not resulted in impacts to Glen Cove Creek. This is expected to remain the case as dissolved phase concentrations decline over time as attenuation and bioremediation processes continue to limit constituent migration and reduce dissolved phase concentrations.
- There are no significant or imminent threats to human health that warrant an interim remedial action. The on-site risks are associated with potential contact with PAHs detected in the Site surface soils, which are presently prevented through Institutional and Engineering Controls. The Institutional Controls currently in place include site awareness and worker training. The current Engineering Controls include a gravel cover, which is restricting direct contact with surface soils and preventing fugitive

dust generation. Also, fencing and gating is maintained at the Site to restrict public access.

- A number of chemicals of potential ecological concern (COPECs) in soil, sediment and surface water exceed some toxicological benchmark values; however, there is little area for ecological communities to come in contact with contaminated media within the Site. Although the COPECs pose a potential risk of impacting local wildlife species this risk is minimal due to several reasons: the industrial/commercial area provides minimal habitat, constant physical disturbance prevents wildlife population from developing; only transient species and few individual animals utilize the area; and the frequency and duration of exposure is limited. Therefore, the observed chemicals detected on site do not pose a current risk nor is any risk expected in the future.
- Soil vapor samples were collected on properties adjacent to the Site to evaluate the potential migration of chemicals of potential concern (COPC) impacting adjacent structures. Although COPCs were detected in soil vapor on these properties above the Upper Fence Values of the New York State Department of Health (NYSDOH) Background Outdoor Air Concentrations, the concentrations were too low to present a risk if associated with adjacent structures. They were also too low to determine whether their presence in the soil vapor was related to activities conducted on these properties versus soil vapor migrating from the Site. Therefore, no further investigation regarding off-site soil vapor was found to be warranted.

3.5 Conceptual Model

As noted in the RI, soil contamination extends vertically to approximately 45 feet below the ground surface of the Site, and to a lesser extent, approximately 61 feet below the ground surface immediately off site to the north. Based on this data, a conceptual model developed an estimate of the contaminant mass in the subsurface. This model utilized historical boring logs, soil concentrations, an average soil bulk density, and visual impacts of DNAPL as noted in each boring log. Based on this estimate, there is approximately 208K pounds of contaminant mass in the soil. Table 3-1 cross-references the estimated distribution of mass versus an approximate depth interval.

Table 3-1 Estimated Contaminant Mass Summary

Depth Interval (ft bgs)	Percent Mass of Total Mass at Site (%)
7 to 13	84
13 to 19	5
19 to 25	4
25 to 31	3
31 to 37	3.4
37 to 45.5	<1

Appendix A provides a summary of the calculations and assumptions used to develop the model. The model first estimated a surface area of contaminant mass for a specific depth interval based on the visual impact of DNAPL as noted in the soil boring logs. Next, the model applied the highest soil concentration to an estimated soil volume and an assumed a soil bulk density in order to estimate the contaminant mass. If a soil sample was not taken for an interval due to the presence of tar, then either an immediately adjacent analytical sample or an average of the samples collected immediately above and below was assumed for that location.

4. Remedial Action Objectives

The NYSDEC remedial program identifies the goal for site remediation under 6 NYCRR Sub-Part 375-2.8(a) as

> "…restore that site to pre-disposal conditions, to the extent feasible. At a minimum, the remedy selected shall eliminate or mitigate all significant threats to the public health and to the environment presented by contaminants disposed at the Site through the proper application of scientific and engineering principles and in a manner not inconsistent with the national oil and hazardous substances pollution contingency plan as set forth in section 105 of CERCLA, as amended as by SARA."

Where restoration to pre-disposal conditions is not feasible, the NYSDEC may approve an alternative criteria based on the Site conditions (6 NYCRR Sub-Part 375-2-8(b)(1). This could include the application of one of the Soil Cleanup Objectives listed in Table 375-6.8(a) (Unrestricted Use) or Table 375-6.8(b) (Restricted Use). Alternatively, the responsible party may "propose site-specific soil cleanup objectives which are protective of public health and the environment based upon other information."

Remedial Action Objectives (RAOs) are medium-specific or operable-unit specific objectives for the protection of human health and the environment. RAOs are developed based on contaminant-specific Standards, Criteria and Guidance (SCGs) and the intended land use.

SCGs are defined in the 2002 NYSDEC Draft DER-10. Standards and Criteria are New York State regulations or statutes that dictate the cleanup standards, standards of control and other substantive environmental protection requirements, criteria, or limitations which are generally applicable, consistently applied, officially promulgated and are directly applicable to a remedial action. Guidance are non-promulgated criteria and guidance that are not legal requirements; however, those responsible for investigation and/or remediation of the Site should consider guidance that, based on professional judgment, are determined to be applicable to the Site.

The site-specific SCGs applied to this site are:

- *TAGM 4030-Selection of Remedial Actions at Inactive Hazardous Waste Sites,*
- *6 NYCRR § 375-1: General Remedial Program Requirements,*
- *6 NYCRR§ 375-2: Inactive Hazardous Waste Disposal Site Remedial Program,*

- *6 NYCRR§ 375-6: Remedial Program Soil Cleanup Objectives.*

Based on the SCGs, the following RAOs were developed for the Site.

Groundwater

- Prevent, to the extent practicable, contact with, or ingestion of contaminated groundwater associated with the Site.
- Prevent, to the extent practicable, the migration of contaminated groundwater from the Site.
- Remove, to the extent practicable, the source of groundwater contamination.

Soil

- Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.

The proposed remedy for the Site will be developed to meet the above Remedial Action Objectives.

5. General Response Actions

Contaminated media to be considered for general response actions includes soil (and related contaminated source material) and groundwater. MGP-related impacts to soil or groundwater were encountered below the fill to a depth of about 45 feet bgs and were present from the south-center of the Site, extending to about 50-feet off site to the north. A (PAH-defined) groundwater plume is present over an approximate one-acre area to a depth up to 45-feet. MGP-related source material and MGP-impacted soil are present over approximately one and a half acres at depths between 8 - and 45-feet bgs. This represents a volume of about 60,000 cubic yards of impacted soil located below about 25,000 cubic yards of fill. **Figure 3-2** defines the extent of media impacted.

The general response actions discussed below will be evaluated as means of achieving the RAOs. The media for which each response action is applicable is indicated along with a brief definition and example technologies.

Treatment (soil, groundwater, source material): Alteration of the physical and/or chemical nature of the subsurface to cause a change in contaminant mass, mobility, or toxicity (examples: chemical oxidation, stabilization, dynamic underground stripping, thermal treatment, soil flushing). In-situ or ex-situ groundwater treatment technologies could also be implemented to address groundwater.

Containment (ground water, source material): Isolation of contaminant source areas by constructing and maintaining physical barriers that prevent continued migration of contamination into groundwater (examples: caps, sheet pile wall, soil-bentonite cutoff wall, active hydraulic control).

Excavation (soil, source material): The removal and subsequent treatment or disposal of contaminated soils and source material. This response action includes excavations to approximate 35- to 45-feet bgs to remove source material and impacted soils, off site treatment and/or disposal, and replacement of excavated material with clean fill from on-site and off-site sources. Due to the depth of the impacted soil beneath the water table, dewatering activities may be required. If dewatering is required, the groundwater extracted would require treatment and disposal via permitted discharge.

Extraction (groundwater): The removal and subsequent treatment, reinjection, or disposal of groundwater from the subsurface via active or passive recovery wells/trenches.

Disposal (soil, groundwater, source material): Off-site treatment of ground water, and soil and source material, as appropriate. Landfilling or recycling of soil and source material.

Engineering Controls (soil, groundwater source material): Construction and maintenance of physical barriers to prevent potential exposures to contamination (examples: caps, fencing).

Institutional Controls (soil, groundwater): Controlling the type and nature of potential human exposures through legal or administrative procedures or programs (examples: Environmental land use restrictions, groundwater use restrictions, Site Management Plan for managing future excavations, Health & Safety Plan for on-site work).

Monitored Natural Attenuation (soil, groundwater): The natural degradation of contaminants in soil and ground water at a rate allowing the stagnation of a groundwater plume advance and gradual retreat with time precluding contaminant impact to a defined down-gradient receptor. Ongoing measurement of groundwater contaminant levels afford a means of ensuring that potential, but currently incomplete, exposure pathways are not completed and that natural attenuation of soil and groundwater constituents is occurring.

The following matrix presents, for each RAO, the general response actions being considered. The response actions are media-specific and the matrix does not explicitly show positive effects on secondary media.

Remedial Action Objectives Glen Cove Former MGP Site	General Response Actions							
	Treatment	Containment	Excavation	Extraction	Disposal	Engineering Controls	Institutional Controls	Monitored Natural Attenuation
▪ Prevent, to the extent practicable, contact with, or ingestion of contaminated groundwater associated with the Site.	X	X		X	X	X	X	X*
▪ Prevent, to the extent practicable, the migration of contaminated groundwater from the Site.		X		X	X			X*
▪ Remove, to the extent practicable, the source of groundwater contamination	X		X	X	X			X*
▪ Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.	X	X	X		X	X	X	X*

*Monitored Natural Attenuation is a long-term remediation and monitoring strategy. It will only meet the RAOs over a long period of time alone or when combined with other general response actions.

6. Identification and Screening of Technologies

6.1 Introduction

In this section, the universe of potentially applicable technologies are identified and screened with regard to site-specific conditions. During this step, technologies are either eliminated or retained for further consideration based on their effectiveness, technical implementability, and cost. The results of this evaluation ultimately contribute to the development of the remedial alternatives that are proposed and analyzed subsequent sections. The following remedial technologies, alone or in combination, are initially considered as potentially applicable for mitigation of contamination at the Site.

6.2 Technology Identification and Screening

Technology identification and screening involves the following steps:

- Assessment of technical issues posed by the Site and the project.
- Identification of potentially applicable technologies.
- Preliminary screening of the technologies with respect to effectiveness, implementability, and cost.

6.2.1 Site Specific Technical Issues

The primary technical issues affecting the effectiveness and implementability of potential technologies at the Site include the following.

- The physical and chemical nature of the MGP-related source material and NAPL.
- Limited access to the source area is available. A significant amount of the source material (DNAPL mass and impacted soil) lies beneath an active electrical substation. Non-impacted backfill was used after the former MGP facility was demolished and excavated.
- The topography of the Site limits remedial alternatives. The Site is located on a small ‘plateau’ or level parcel with a slight to moderate downhill slope bordering on the west and southwest, and steep uphill slopes bordering to the north, east, south and southeast.
- The slopes show notable signs of erosion along the north, east, and in particular, the south and southeast. The stability of these slopes is uncertain and would require geotechnical analysis if any type of earthwork is performed at the Site (e.g. source

removal via excavation). As a result, significant shoring and earth support construction may be required.

6.2.2 Discussion of Technical Issues

MGP-derived NAPLs are complex chemical mixtures. The physical and chemical properties of the NAPL (i.e. specific gravity, solubility, volume and mass distribution within the soil matrix, etc.), and the hydrogeologic properties of the soil matrix (i.e. capillary pressures, grain-size distribution, porosity, hydraulic conductivity and gradient, etc.), determines the mobility of the NAPL within the subsurface. The NAPLs present in the subsurface are likely not uniform in either their physical or chemical characteristics. The weathering and mixing with soil and groundwater that has occurred over time has likely made these NAPLs even less of a pure, consistent product. The RI data and recent groundwater monitoring have reported that the DNAPL present on site is not readily mobile and observed at less than a foot in only one monitoring well, GCMW-13S. In June 2005, the DNAPL thickness in GCMW-13S measured approximately 0.74 feet, and decreased steadily to 0.54 and 0.34 feet in August and October 2005, respectively. In February 2008, the DNAPL thickness measured approximately 0.45 feet. There has not been any other monitoring event since February 2008. Additional data on the rate of NAPL recovery would be necessary to design additional recovery wells. This data be developed through a pilot study measuring recovery rates in monitoring well GCMW-13S following DNAPL removal.

Maintenance of uninterrupted electric power to the residences near the Site will be difficult with an intrusive remedial measure and will prove critical to community acceptance of any remedy proposed. The proximity of critical infrastructure of the active electrical substation (i.e. above and belowground utilities, etc.) poses significant limitations toward any intrusive remedial activity. Because MGP-related source material and residual NAPL mass is present beneath the substation, its complete removal would require the substation to be demolished, its services relocated, and the station subsequently re-built. Accessible MGP-related source material is present in areas outside of the active substation and associate infrastructure. This material may be removed without significant disruption to the substation.

The hydrogeologic and topographic characteristics of the Site pose several additional challenges. The relatively shallow depth to groundwater (approximately 8-10 ft bgs) and the steep topographic slopes to the north, east, and south mean that any significant excavation beyond 10 feet may require construction dewatering and earth support structures. Furthermore, the slopes would require some geotechnical analysis to determine their stability and the degree of support they would require.

6.2.3 Preliminary Technology Screening

Based on the technical issues listed above, this initial review can eliminate several intrusive remedial options. These options include groundwater pump and treatment/soil vapor extraction (PT/SVE), thermal or steam injection and vapor extraction, and subsurface containment barrier walls. While a PT/SVE system may obtain hydraulic and vapor control of the groundwater plume, it would only have a passive or limited effect on the residual DNAPL mass present in the source area. Therefore, operation of this type of technology would produce diminishing returns and the residual DNAPL would continue to affect groundwater concentrations. Thermal or steam injection would require a large amount of ancillary equipment to generate the steam or heat, deliver it to the target area, and capture and treat the volatilized contaminant mass. Furthermore, physically installing the thermal couples or steam injectors in the required locations would be difficult given that a significant portion of the contaminant mass is present beneath the electric substation. This would likely disrupt operation of the power station and require significant modification to the property.

Construction of a subsurface containment barrier wall (i.e. funnel and gate, slurry wall, etc.) could significantly disrupt the operation of the power station; and would require a significant amount of modification to the land to accommodate the heavy machinery and installation activities. In addition, based on the steepness and uncertain stability of the surrounding slopes, the installation activities would require ancillary earth support structures to prevent any damage to the electric substation or the surrounding properties. Furthermore, this type of containment is not necessary. As noted in the RI, the groundwater plume is stable and believed to be degrading under natural processes; and therefore, does not warrant immediate containment to mitigate the risks identified in the RI. Historical and the most recent monitoring activities indicate that the DNAPL is relatively confined to one monitoring well and is not migrating off site. Therefore, only remedial activities and/or in-situ technologies that can control or reduce the flux of contaminants from the MGP-related source material into the groundwater, and/or enhance the current natural attenuation processes are retained for alternative development and analysis.

In order to meet the RAOs and overcome these technical challenges, the remediation of the soil, groundwater, and MGP-related source material at the Site will need to be focused on altering the physical and/or chemical nature of the subsurface to cause a change in contaminant mass, mobility, or toxicity (examples: partial removal of MGP-related source material, stabilization, bioremediation). To that end, in-situ remedial alternatives provide the best opportunity and most efficient manner to meet the RAOs for the Site. As noted in the RI, the groundwater plume is relatively stable and believed to be degrading under natural processes. In-situ technologies are designed to facilitate a progression toward supporting and accelerating those natural attenuation processes without exacting significant alterations to the current site conditions.

If feasible, this type of alternative could also include a partial removal of the MGP-related source material ("hot spot" removal) to further reduce the flux of contaminants from the MGP-related source material into the groundwater. Regardless of the selected alternative, ongoing measurement of ground water contaminant levels would continue to ensure that contaminated discharge to Glen Cove Creek is not occurring, and the natural attenuation of the contaminants is occurring.

In accordance with 6 NYCRR Subpart 375-2.8, subparagraph (c)2.i, remedial options evaluated must include an alternative that can return the Site to "pre-release" conditions. Therefore, the remedial alternatives analysis will include a full-site excavation or complete MGP-related source material removal. However, the technical issues listed above present significant challenges to its completion, namely the desire to prevent or minimize disruption to the services provided by this substation.

The remedial technologies considered and screened were evaluated based on their ability to actively address the RAOs while minimally affecting the power station's utility, and be completed in a reasonably cost-effective manner. The remedial technologies/techniques considered and screened for the site include:

- Monitored Natural Attenuation (MNA);
- Institutional Controls;
- Surface Cap;
- NAPL Recovery;
- In-Situ Biogeochemical Stabilization (ISBS);
- Enhanced Bioremediation via Oxygen Injection;
- Air Sparging/Soil Vapor Extraction (SVE);
- Focused Source Area Excavation or "Hot Spot" Excavation;
- In-situ stabilization (cement/slurry injection);
- Excavation and treatment/disposal of all material exceeding the unrestricted use cleanup objectives on site and off site to a maximum depth of contamination in the saturated zone to restore site to pre-release conditions.

6.2.4 Technology Identification

Potential remedial technologies were identified from experience and review of available technical publications. The technologies are categorized according to the general response actions developed in Section 5 and are summarized in Table 6-1.

Table 6-1
Summary of Remedial Technology Screening
Glen Cove Former MGP

General Response Action	Technology	Effectiveness	Implementability	Cost	Status for Alternative Development
Treatment	**In-Situ Biogeochemical Stabilization (ISBS)** targets the NAPL and contaminants of concern (COC) in the saturated zone. Technology represents a means removing NAPL mass, and reducing the flux of the COC into the groundwater. ISBS entails the use of catalyzed and buffered solution of sodium or potassium permanganate to react and destroy dissolved phase COCs, leach out the lower molecular weighted COCs from the NAPL for destruction, and harden or "chemically weather" the residual NAPL. The resulting catalyzed manganese dioxide precipitates and physically stabilizes the NAPL by creating "crusts" or "shells around the organic interface of the NAPL and soil particles.	Effective at meeting soil and groundwater related RAOs. Effectiveness is uncertain on vadose zone soils. It is likely effective at reducing the COC flux into the groundwater; however, there could be an initial spike in groundwater concentrations of the lighter molecular weighted COCs (e.g. benzene). Therefore, additional remedial measures may need to address the potential COCs that could leach off the treated source material. In addition, multiple injections may be required to complete stabilization of the source material or treat the leached material. Extensive long term monitoring may be required to demonstrate the permanence of the remedy and the natural attenuation of the residual groundwater plume outside and off site of treatment area. This is an innovative technology, so long term monitoring of the results are not available from other sites.	Technology is innovative and has proven effective in current applications. It is readily implemented to depths anticipated. Injection points will need to access source areas to achieve optimum effectiveness. However, site constraints may restrict its implementability, and may require horizontal drilling procedures. Leachability testing may be required to measure the immobilization of contaminant. Bench scale testing could be required to develop dosages. Field pilot testing would also be required to ensure no upheaval or subsidence affects would occur beneath the LIPA substation structure and infrastructure. Due to the Site constraints, the technology may be applicable in conjunction with other technologies (e.g. MNA). However, the extensive testing required prior to mobilization cannot be accomplished within the schedule for the Site owner's future construction.	Medium costs relative to other treatment technologies (e.g. containment wall/sheeting)	Not Retained

General Response Action	Technology	Effectiveness	Implementability	Cost	Status for Alternative Development
Treatment	**Enhanced Bioremediation via Oxygen Injection.** A process in which oxygen gas is diffused into the groundwater to create an aerobic environment that will facilitate the biodegradation of the COCs in the saturated soil and/or ground water by indigenous aerobic micro-organisms (e.g., bacteria). Thus, converting them to innocuous end-products.	Effective at meeting soil and groundwater related RAOs in saturated zone. Effectiveness is uncertain on vadose zone soils. Promotes natural attenuation of residual groundwater contamination down-gradient from injection areas. Extensive long term monitoring may be required to demonstrate the permanence of the remedy.	Technology is proven on groundwater and saturated soils. The technology is readily implemented to depths anticipated. Variable subsurface soil permeability, site constraints and subsurface electrical transmission lines may restrict installation of injection points. Installation may require horizontal drilling procedures. Field pilot testing required to determine radius of influence and injection flow-rates and pressures.	Medium relative to other treatment technologies.	Retained for alternative development
Treatment	**Air Sparge/SVE.** This technology is the injection of pressurized air into the subsurface below the water table to induce volatilization of dissolved phase COCs. The vaporized components of the contaminants then migrate into the vadose zone for subsequent capture by vacuum extraction wells and ultimately ex-situ treatment.	Effective at meeting groundwater related RAOs. Limited effectiveness towards meeting soil RAOs; the technology is more effective at treating contaminants in dissolved phase versus COCs in the vadose zone. However, injected air will increase the dissolved oxygen content in the groundwater, which will in turn stimulate aerobic bioactivity and natural attenuation of the COCs within the soil.	Variable soil permeability and site constraints may restrict implementability of remedy. Injection and extraction points will need to access the source area to achieve optimum effectiveness. Extensive horizontal drilling procedures might be required. Off-gas treatment required, and related residual liquids may require treatment/disposal. Spent activated carbon will require regeneration or disposal.	Capital and maintenance costs medium to high compared to other technologies	Not Retained

General Response Action	Technology	Effectiveness	Implementability	Cost	Status for Alternative Development
Containment	**In-Situ Stabilization (cement/slurry injection)**. This technology physically binds or encloses a COC mass or induces a chemical reaction between the stabilizing agent and the COCs to reduce their mobility within the subsurface. It involves injecting a binding reagent (e.g. cement/slurry mixture) into contaminated soil with soil auger/caisson and injector head systems.	Effective at meeting groundwater and soil related RAOs. The effectiveness is dependent on the ability to get the stabilizing agent in contact with the NAPL or COCs. In addition, the ability to prevent vertical migration of NAPL and its leachate is enhanced with a bottom barrier (i.e. natural clay layer, bedrock, or grouted layer). Therefore, given the Site constraints, horizontal drilling techniques could be required to obtain better contact with the source material or install a bottom barrier. Additional remedial measures may need to address the potential COCs that could leach off the treated source material. In addition, multiple injections may be required to complete stabilization of the source material or treat the leached material.	Technology proven and readily implemented to depths anticipated. Implementation of this technology is highly dependent on the physical properties of soil. Injection points will need to access the source area to achieve optimum effectiveness. Extensive horizontal drilling procedures might be required. Bench tests may be required. Leachability testing is typically performed to measure the immobilization of contaminant. Field pilot testing would also be required to ensure no upheaval or subsidence affects would occur beneath the LIPA substation structure and infrastructure.	High costs relative to other containment technologies (e.g. containment wall/sheeting)	Not Retained

General Response Action	Technology	Effectiveness	Implementability	Cost	Status for Alternative Development
Containment	**In-Situ Biogeochemical Stabilization (ISBS)**. See description above.	Effective at meeting soil and groundwater related RAOs. Effectiveness is uncertain on vadose zone soils. As a containment technology, it is likely effective at reducing the COC flux into the groundwater. However, there could be release of the lighter molecular weighted COCs. Therefore, multiple injections may be required to treat and contain the leached material. Extensive long term monitoring may be required to demonstrate the permanence of the remedy and its stabilization of the NAPL.	See description above.	Medium costs relative to other containment technologies (e.g. containment wall/sheeting)	Not Retained
Excavation	**Excavation/Removal of Source Material.** This technology involves digging up source material and transporting it to an appropriate disposal facility (i.e. landfill, soil treatment facility, etc.). Excavated material is usually staged and sampled for waste characterization. Any significant excavation beyond 10 feet may require construction dewatering and earth support structures.	Effective at meeting soil and groundwater related RAOs. Because of site restraints and the desire to maintain operation of the LIPA substation, partial source material removal or "hot spot" excavations would only be effective at reducing the COC flux into the groundwater and reducing the residual mass in the soil.	Technology proven and readily implemented to depths anticipated. However, site constraints (i.e. LIPA substation structure and infrastructures, site topography, and shallow groundwater) may require construction dewatering and earth support structures. Full source material removal would require the demolition of the LIPA substation.	High relative to other technologies.	Retained for alternative development
Extraction	**NAPL Recovery.** This technology involves the extraction of free-phase NAPL from a monitoring or recovery well. The NAPL accumulates in the well, and is then pumped into a designated tank or container for off-site disposal or recycling at an	Does not meet groundwater and soil related RAOs. However, it is effective at removing free-phase NAPL from the subsurface; and therefore, reducing the COC flux into the groundwater.	Technology proven and readily implemented. Pilot tests may be required to determine recovery rates, NAPL mobility, equipment and disposal requirements,	Low relative to other technologies	Retained

General Response Action	Technology	Effectiveness	Implementability	Cost	Status for Alternative Development
	appropriate facility.				
Disposal	**NAPL Recovery.** See description above.	See description above.	See description above.	Low relative to other technologies	Retained
	Soil Excavation. See description above.	See description above.	See description above.	High relative to other technologies.	Retained
Engineering Controls	**Surface Cap.** This technology involves installing a soil and/or concrete surface over the entire site to prevent contact with COCs and reduce storm water infiltration into the groundwater.	As a sole technology, it is not effective at meeting groundwater and soil related RAOs. It would require additional technologies to meet groundwater and soil related RAOs. Effective at controlling exposure to future construction/utility workers and trespassers May include a low permeability barrier to minimize infiltration of precipitation to source area reducing flux of dissolved contaminants.	Technology proven and readily implemented.	Medium relative to other technologies.	Not Retained
Institutional Controls	**Access Controls** **Deed Restrictions** **Health & Safety Plans** **Long-Term Monitoring** **Notifications.**	Effective in preventing risks to future construction/utility workers and trespassers . Not effective in limiting migration.	Readily implemented.	Low. .	Retained for alternative development.
Monitored Natural Attenuation	**Monitored Natural Attenuation** refers to the reliance on natural processes to achieve site-specific remedial objectives. The natural attenuation processes include a variety of physical, chemical, or biological processes that, under	Effective at meeting soil and groundwater related RAOs when used in conjunction with source control. Extensive long term monitoring is required to demonstrate the effectiveness of the remedy.	Implementation is determined as a function of a detailed evaluation of physical and chemical soil and groundwater characteristics including soil and groundwater chemistry, groundwater hydraulics, and biodegradation	Medium compared to other technologies	Retained for alternative development

General Response Action	Technology	Effectiveness	Implementability	Cost	Status for Alternative Development
	favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or ground water. These processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants.		processes associated with microbial activity related to such compounds as oxygen, carbon dioxide, nitrate, sulfate and iron. Through computer modeling of groundwater flow and contaminant dispersion and degradation a determination is made as to the efficacy of the approach.		

6.2.5 Technology Screening

Table 6-1 also presents a screening evaluation of the technologies, according to the following criteria: effectiveness, implementability, and cost. The technologies are judged against their effectiveness at achieving the RAO's, their implementability, and its relative cost. Based on the ability of a remedial technology to meet these criteria, the summary table concludes whether the technology is retained for further remedial alternatives development.

6.3 Summary of Retained Technologies

The remedial technologies retained for further alternative development and analysis are:

- No-Action;
- Institutional controls (Environmental Land-Use Restriction (ELUR), which includes deed restrictions/environmental easements for future uses of the Site, and specific protocol to manage future ground-intrusive work);
- Monitored Natural Attenuation (MNA);
- Enhanced Bioremediation via Oxygen Injection;
- Focused or partial "hot spot" excavation;
- NAPL Recovery;
- In-situ Biogeochemical Stabilization;
- Excavation and treatment/disposal of all material exceeding the unrestricted use cleanup objectives on site and off site to a maximum depth of contamination in the saturated zone to restore site to pre-release conditions.

7. Development and Analysis of Alternatives

7.1 Introduction

This section assembles retained remedial action and technologies into a list of site-wide remedial alternatives. These alternatives are developed below and defined with respect to the criteria set forth in 6 NYCRR Subpart 375-2.8(c)(2)(i) and in general accordance with Section 4.2(a)(5)(i) of NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation (DER-10). Each alternative is evaluated against the nine criteria outlined 6 NYCRR Subpart 375-2.8(f) and a comprehensive analysis of the alternatives is presented.

Each alternative was developed to address RAOs and reduce the resultant flux of dissolved contaminants from the Site to down-gradient points. To the extent practicable, the proposed remedial alternatives remove, contain, or destroy MGP-related source material in the subsurface.

Implementation of the majority of the alternatives will require some modification to the current grade of the property. Some alternatives may require temporary disruption to the utility of services provided by the LIPA substation. These disruptions would result from remedial construction and implementation logistics and not by potential human or ecological exposure to contaminants.

The LIPA substation is a critical piece of the local utility infrastructure of the community. As noted in the RI, no change to this land use is anticipated in the future. As such, there will be no change to the current exposure scenarios at the LIPA substation where ingestion/dermal contact was unlikely and could be effectively managed through institutional and/or engineering controls. Therefore, with the exception of the first alternative, all alternatives will include specific institutional controls and a Soil Management Plan that will limit and mitigate the risks posed by any subsurface disturbance. Institutional controls will provide site restrictions and notifications to prevent potential exposures and maintain controls currently in place (i.e. domestic drinking water restrictions, site access restrictions). The Soil Management Plan will provide guidance to mitigating any potential exposure to contaminants in the event of subsurface disturbance. This guidance will include the means and methods required to remove, treat, and dispose of impacted soils if deemed necessary.

As noted in the RI, the groundwater plume is relatively stable and believed to be degrading under natural processes. Therefore, with the exception of the first alternative, a groundwater monitoring program that will monitor for MGP-related contaminants and their natural attenuation on site and down-gradient from the Site is included with each alternative.

7.2 Description of Alternatives

Each alternative retained is described in more detail below, using the context of Section 4.2(a)5(i) of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Some of the alternatives specify the use of an engineered treatment barrier/zone to reduce or mitigate the dissolved phase contaminant flux from the Site to down-gradient points. National Grid is currently evaluating several technologies, including oxygen injection, at other National Grid sites. Results of these evaluations may be applicable to this site and may be used to design site-specific tests of potentially applicable technologies.

A Community Air Monitoring Plan (CAMP) will be included in the selected alternative and implemented during the remedial activities.

The details of the seven retained alternatives follow.

7.2.1 Alternative 1: No Action

Alternative 1 is the “No Action” alternative. This alternative assumes that the base conditions existing at the Site will not be addressed through remedial actions and the Site property would be available for unrestricted use. Even though the RI noted that the groundwater plume is stable and believed to be degrading under natural processes, this alternative does not address the soil and groundwater related RAOs. Under the “No Action” alternative, this process would not be monitored by NGRID or NYSDEC personnel.
With respect to the guidance identified above in subsection 7.1 and 7.2, the alternative is described as follows:

- ***Size and configuration***. As no actions will be performed, no portion of the Site area will be disturbed.
- ***Time for Remediation.*** The alternative does not require any action; therefore, there is no time for remediation required.
- ***Spatial Requirements.*** As no actions will be performed, there is no requirement for access to private properties or large support areas.
- ***Options for Disposal.*** There is no material that will require disposal as part of this remedy.
- ***Permit Requirements.*** No permit requirements are anticipated.

- ***Limitations.*** This alternative assumes that baseline conditions pose no unacceptable health or environmental risks.
- ***Ecological Impacts.*** As no action will be performed, this alternative will not have any ecological impacts, beyond baseline conditions.

7.2.2 Alternative 2: Monitored Natural Attenuation and NAPL Recovery

Alternative 2 consists of Monitored Natural Attenuation (MNA) using adaptive management processes. Contaminants associated with MGP-impacts will degrade with increased time and distance from the source area. As noted in the RI, the groundwater plume is stable and believed to be degrading under natural processes.

MNA refers to the reliance on natural processes to achieve site-specific remedial objectives. The natural attenuation processes include a variety of physical, chemical, or biological processes that, under favorable conditions, act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or ground water. These processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical or biological stabilization, transformation, or destruction of contaminants.

Extensive long term monitoring is required to demonstrate the effectiveness of the remedy. This monitoring will be required to evaluate the physical and chemical soil and groundwater characteristics and chemistry, groundwater hydraulics, and an assessment of the biodegradation processes associated with microbial activity. In addition to monitoring for contaminants, this assessment will need to monitor such compounds as, but not limited to, dissolved oxygen, nitrate, sulfate and iron.

An MNA program would include evaluation and measurement of the following criteria:

- Contaminant weathering, transformation and risk attenuation;
- Contaminant distribution and migration;
- Assessment of the bioactivity and its degradative environment (e.g. aerobic vs. anaerobic)

Figure 7-1 depicts the proposed monitoring locations that would be included in an MNA remedy.

In addition to MNA of groundwater, this alternative includes NAPL recovery. NAPL will be collected via regular extraction events at any current monitoring well that contains measurable NAPL. The frequency, means, and methods of each extraction events will be evaluated based on data generated from groundwater monitoring activities. The collection system will be passive in nature, collecting on a periodic basis only when free NAPL readily enters a monitoring well. Due to the historical measurements of NAPL thickness and ground-water stability as noted in the RI, no mobility enhancers would be injected into the subsurface to increase the rate and quantity of extraction. Collected NAPL will be stored in 55-gallon drums on site and taken off site for disposal at an appropriate facility.

- With respect to the guidance identified above in subsection 7.1 and 7.2, the alternative is described as follows:
- ***Size and configuration***. Limited disturbance of the Site will be required to install additional monitoring wells and DNAPL recovery wells.
- ***Time for Remediation.*** The amount of time for remediation is likely to be long-term based on current practices and understandings of natural attenuation process of MGP-related contaminants.
- ***Spatial Requirements.*** There is no requirement for access to private properties or large support areas beyond current access agreements. The current agreements would be maintained for monitoring activities.
- ***Options for Disposal.*** Collected NAPL will be stored in 55-gallon drums for off-site disposal at an appropriate facility.
- ***Permit Requirements.*** No permit requirements are anticipated.
- ***Limitations.*** This alternative assumes that baseline conditions currently pose no unacceptable health or environmental risks and are being attenuated.
- ***Ecological Impacts.*** This alternative will not have any ecological impacts, beyond baseline conditions.

7.2.3 Alternative 3: Accessible Source Material ("Hot Spot") Removal, Enhanced Bioremediation with Oxygen Injection, MNA, and NAPL Recovery

Alternative 3 consists of combining Alternative 2 with a removal of accessible MGP-related source removal ("hot spots") that are known to contain significant amounts of NAPL mass and enhancing the current natural attenuating processes occurring at the Site by injection oxygen into the groundwater. Accessible MGP-related source material refers to source material not located under the active substation or associated infrastructure. This removal will reduce the amount of NAPL that is contributing to the groundwater concentrations on and off site and in combination with the oxygen injection, increase the bioactivity conducive to degrading MGP-related contaminants.

Due to the technical issues discussed in Section 6, the removal of all shallow MGP-related source materials ("hot spots") that are known to contain significant amounts of NAPL mass may be difficult to accomplish given the Site constraints. Therefore, this alternative would focus on removal of accessible MGP-related source materials in the upper 6-15 feet of the Site. Since impacted material would be left at depth under this removal alternative, the removal would be combined with an oxygen injection system to inject oxygen along the Site boundary down gradient from the source area. This will address the bioremediation of the lower molecular weighted contaminants, which have the potential to leach off the residual MGP-related source material and migrate down gradient from the Site. The injected oxygen will create an aerobic environment along the Site boundary, which will in turn stimulate the activity of the native aerobic bacteria and create an active aerobic treatment zone. As described in subsection 7.2.4, these types of bacteria have an affinity towards degrading the MGP-related contaminants.

Within the substation fence line, clean utility corridors will be established for future substation upgrades. As noted in the RI, the upper 8 feet of material at the site consists of urban fill materials imported to the soil after the MGP operations ceased. Therefore, in order to remove any MGP-related mass, excavations must extend below 8 feet. Excavations within the active substation are limited to depths less than 8 feet because the use of vacuum excavation methods are required. Excavation depths outside the active substation fence line will be limited to 6 to 15 feet bgs. This would target the removal of the accessible MGP-related source material or “hot spots”. The excavated areas would then be backfilled with a visual excavation barrier and clean fill and compacted to grade. Material left in place under the hot spot excavations and within the active substation will be addressed through the installation of NAPL recovery wells and an Environmental Land Use Restriction (ELUR).

Figure 7-2 depicts the proposed areas of excavation and groundwater treatment. By removing the MGP-related source materials (between 6 and 15 feet bgs), the resulting groundwater contaminant flux through this area is reduced; and therefore, the down-gradient groundwater concentrations will be reduced. Material excavated would be properly characterized, staged and transported off site for disposal at an appropriate facility.

The oxygen injection technology involves the injection of a 90 to 95 percent pure oxygen gas into groundwater to increase the dissolved oxygen concentration and enhance aerobic biodegradation of MGP-related contaminants (i.e. BTEX and naphthalene). The technology filters ambient air to generate 90 to 95 percent pure oxygen gas, which is then injected in pulsed intervals into the subsurface through a series of injection wells at low flow rates.

The low flow rates and pulsed injection intervals are cycled to allow for the maximum transfer of vapor-phase oxygen to dissolved-phase oxygen. Unlike air sparging, the goal of oxygen injection is to transfer the injected vapor to the aqueous phase. The goal of air sparging is to maintain the injected vapors in the vapor phase where they can strip the VOCs, such as BTEX, from the groundwater for collection in the vadose zone and subsequent treatment. Slowly injecting oxygen at 90 to 95 percent purity can increase dissolved oxygen concentrations to a maximum of approximately 40 milligrams per liter (mg/L). Whereas air injected under sparge processes yields maximum dissolved oxygen concentrations of approximately 9 mg/L. The injected oxygen will significantly increase the dissolved oxygen concentrations in the injected area. Dissolved oxygen then stimulates the activity of the indigenous aerobic microorganisms. This type of bacteria, when stimulated has an affinity to degrade MGP-related contaminants. Therefore, by injecting oxygen and significantly increasing the dissolved oxygen concentrations, an active aerobic treatment zone is formed near the injection area. When groundwater passes through this zone, it becomes oxygenated and the stimulated aerobic microbes begin to actively degrade the MGP-related contaminants.

The injection line designed for the Site is constructed to traverse the flow path of the groundwater plume prior to migrating off site. By creating and maintaining an aerobic environment here, the oxygen injection system will reduce the groundwater contaminant mass as it migrates off site.

Due to the technical issues discussed in Section 6, this alternative offers an option to reduce the contaminant mass contributing to the groundwater plume and avoid major interruption and modification to the service and structure of the LIPA substation. However, there are logistical concerns that could hinder this alternative. There is very little room at the Site in the vicinity of these “hot spots” to operate the required earth-moving machinery. Restrictions are in place that restrict the size of the excavation area in the vicinity of the underground electric lines conveying power to the main utility poles as well as excavation within the fenced active substation. Additional restrictions limit the operation of equipment near or below the overhead transmission lines. These overhead transmission lines will require protection and/or clearance to prevent damage from excavation equipment and potential electrical arcing between the lines and equipment. Excavations will be limited in the vicinity of concrete piers for the transmission poles/towers. A setback distance will be established to protect these structures during excavation. The southern portion of the Site would require significant modification and re-grading to accommodate the excavation machinery, dump truck loading, and a soil staging area. Dump trucks would be required to wait along Grove Street, or a remote staging area, prior to receiving a load of soil material. The relatively shallow depth to groundwater (approximately 10 feet bgs); the surrounding steep topographic slopes and their uncertain stability; and the LIPA substation structure mean that any significant excavation beyond 10 feet may require construction dewatering and earth support structures. All groundwater generated will be treated and discharged under regulatory approved discharge permits.

- ***Size and configuration***. **Figure 7-2** illustrates the conceptual plans of this alternative. Because of the relatively shallow depth to groundwater (approximately 10 feet bgs), the steep topographic slopes to the north, and the LIPA substation structure and infrastructures mean that any significant excavation beyond 10 feet may require construction dewatering and earth support structures. In addition, temporarily staging of excavated soil may be required. These factors would require significant alteration of the landscape of the Site. A small storage shed will be required to house the treatment or oxygen generation equipment. Some clearing, grubbing, and re-grading of the Site may be required to accommodate construction equipment for installation of the oxygen injection wells. Additional monitoring wells will be installed at the site downgradient boundary. DNAPL recovery wells will be installed within the active substation.

- ***Time for Remediation.*** The amount of time for remediation is likely to be moderate. It will likely take 3 months to complete the "hot spot" removal of the soil as described above. Due to the time constraints identified for the construction of the substation upgrade, the excavation activities will be performed as an interim remedial measure in the spring 2010. Installation of the oxygen injection system can be completed in approximately 1 month. The oxygen injection system will remain in place to continue enhancing the natural attenuation processes currently observed at the Site. Therefore, operation of this system, as well as MNA and NAPL recovery activities may continue indefinitely on a long-term basis.
- ***Spatial Requirements.*** This alternative will require substantial room for equipment and material storage, access, logistics, and operation. With some alteration (i.e. clearing and grubbing, regarding, etc.), the Site can accommodate these needs, but careful staging and sequencing of the work will be required. There is no requirement for access to private properties or large support areas beyond current access agreements. The current agreements would be maintained for monitoring activities. A trailer or small shed would be required for the oxygen injection system.
- ***Options for Disposal.*** Collected NAPL will be stored in 55-gallon drums for off-site disposal at an appropriate facility. Options for disposal of excavated soil, soil cuttings from injection well installation, and decontamination liquids are readily available. It is not anticipated that construction dewatering will be required.
- ***Permit Requirements.*** It is not anticipated that construction dewatering will be required under this alternative. Decontamination liquids will be containerized and shipped off site for disposal. Therefore, this alternative will avoid the need for dewatering and discharge permitting. Local permits will be required for construction. A NYSDOT permit would be required to construct a temporary construction entrance from Route 107.
- ***Limitations.*** Further analysis of earth support requirements may identify technical or logistical barriers to feasibility.

- ***Ecological Impacts.*** This alternative will not have any ecological impacts, beyond baseline conditions.

7.2.4 Alternative 4: Restoration to Pre-Release Conditions

This alternative would require the excavation and treatment/disposal of all source areas and impacted areas to a maximum depth of contamination in the saturated zone to restore site to "pre-release conditions." Groundwater extracted due to dewatering activities would be treated and disposed of via permitted discharge. This alternative would require removing the electric substation and providing an alternate location for its services.

7.3 Evaluation Criteria

6 NYCRR Part 375.1.8(f) requires a detailed analysis of remedial alternatives against nine criteria and specifies specific factors to consider for each criterion. The nine criteria are:

7.3.1 Overall Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, assessing how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, engineering controls or institutional controls. The remedy's ability to achieve each of the RAOs is evaluated.

7.3.2 Compliance with Standards, Criteria, and Guidance (SCG)

Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance. All SCGs for the Site will be listed along with a discussion of whether or not the remedy will achieve compliance. For those SCGs that will not be met, provide a discussion and evaluation of the impacts of each, and whether waivers are necessary.

7.3.3 Long-term Effectiveness and Permanence

This criterion evaluates the long-term effectiveness of the remedy after implementation. If wastes or treated residuals remain on site after the selected remedy has been implemented, the following items are evaluated:

- The magnitude of the remaining risks (i.e., will there be any significant threats, exposure pathways, or risks to the community and environment from the remaining wastes or treated residuals?)
- The adequacy of the engineering and institutional controls intended to limit the risk

- The reliability of these controls
- The ability of the remedy to continue to meet RAOs in the future

7.3.4 Reduction of Toxicity, Mobility or Volume with Treatment

The remedy's ability to reduce the toxicity, mobility or volume of site contamination is evaluated. Preference should be given to remedies that permanently and significantly reduce the toxicity, mobility, or volume of the wastes at the Site.

7.3.5 Short-term Effectiveness

The potential short-term adverse impacts and risks of the remedy upon the community, the workers, and the environment during the construction and/or implementation are evaluated. A discussion of how the identified adverse impacts and health risks to the community or workers at the Site will be controlled, and the effectiveness of the controls, should be presented. Provide a discussion of engineering controls that will be used to mitigate short-term impacts (i.e., dust control measures). The length of time needed to achieve the remedial objectives is also estimated.

7.3.6 Implementability

The technical and administrative feasibility of implementing the remedy is evaluated. Technical feasibility includes the difficulties associated with the construction and the ability to monitor the effectiveness of the remedy. For administrative feasibility, the availability of the necessary personnel and material is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, etc.

7.3.7 Cost

Capital, operation, maintenance and monitoring costs are estimated for the remedy and presented on a present worth basis.

7.3.8 Community Acceptance

This criterion gauges the acceptance of the selected remedial alternative by the community at large. It is not provided in this document. It is evaluated and summarized by the NYSDEC as part of the public participation period, which precedes final approval of this Remedial Action Plan (RAP).

7.3.9 Land Use

The NYSDEC may consider the current, intended, and reasonably anticipated future land uses of the Site and its surroundings in the selection of the remedy.

7.4 Evaluation of Alternatives

7.4.1 Alternative 1: No Action

- ***Overall Protection of Public Health and the Environment.*** This alternative does not effectively control the potential exposure pathways. No monitoring will be performed to determine if exposure pathways are complete and if exposure frequency is measurable.

  The alternative does not achieve each RAO as described below:

  - *Prevent, to the extent practicable, contact with, or ingestion of contaminated groundwater associated with the Site.* Affected groundwater at the Site is not currently used for water supply; however, no actions are taken towards this objective by this alternative.
  - *Prevent, to the extent practicable, the migration of contaminated groundwater from the Site.* No actions are taken towards this objective by this alternative. As stated in the RI, the groundwater plume is stable and believed to be degrading under natural processes. However, no monitoring program is established under this alternative to document attenuation.
  - *Remove, to the extent practicable, the source of groundwater contamination.* No actions are taken towards this objective by this alternative. The source of groundwater would remain at the Site.
  - *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* No actions are taken towards this objective by this alternative.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** As stated in the RI, the groundwater plume is stable and appears to be attenuating under natural conditions, and the magnitude of the remaining risks is low given the lack of MGP-related contaminant concentrations in Glen Cove Creek and soil vapor samples. However, this alternative does not comply with the site-specific SCGs. This alternative makes no effort towards eliminating the source of groundwater contamination and thereby reducing the soil and groundwater concentrations.

- ***Long-Term Effectiveness and Permanence.*** Natural attenuation processes appear to be effective at mitigating the plume and its associated risks; however, no monitoring will be performed to determine the effectiveness of these natural processes. As a result, the long term effectiveness and permanence cannot be determined.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** Natural attenuation processes of weathering and degradation will eventually reduce toxicity. As such, the total volume of MGP residuals at the Site can only decrease with time. However, no monitoring will be performed to determine rate, amount and extent of these reductions.

- ***Short-Term Effectiveness.*** This alternative will not require any intensive construction activity. No potential short-term impacts are expected.

- ***Implementability.*** As no actions will be performed, the alternative is readily implementable.

- ***Cost.*** There are no anticipated costs for this alternative.

7.4.2 Alternative 2: Monitored Natural Attenuation and NAPL Recovery

- ***Overall Protection of Public Health and the Environment.*** This alternative monitors and controls the potential exposure pathways. Monitoring activities performed under an MNA program will help determine if exposure pathways are complete and if exposure frequency is measurable. The flux of contaminants flowing towards down-gradient points will be reduced to the extent practical by recovering free-phase NAPL from the Site. In addition, future potential exposures are managed by establishing institutional controls.

  The alternative does achieve each RAO as described below:

  - *Prevent, to the extent practicable, contact with, or ingestion of contaminated groundwater associated with the Site.* Affected groundwater at the Site is not currently used for water supply. The institutional controls implemented with this alternative will prevent future groundwater use.
  - *Prevent, to the extent practicable, the migration of contaminated groundwater from the Site.* As stated in the RI, the groundwater plume is stable and believed to be attenuating under natural processes. This alternative would implement a monitoring program to measure and ensure attenuation processes are progressing. This alternative removes free-phase NAPL and therefore, reduces its contribution to the migration of contaminated groundwater.
  - *Remove, to the extent practicable, the source of groundwater contamination.* Free-phase NAPL is removed from groundwater monitoring/recovery wells and disposed off site at an appropriate facility. Its removal will ultimately

reduce one source of groundwater contamination. Natural attenuation processes will mitigate the rest.

- *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Under current site conditions as stated in the RI, ingestion/direct contact with soil contaminated with MGP-related COCs is not a risk and would be mitigated under imposed institutional controls.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** As stated in the RI, the groundwater plume is stable and appears to be attenuating under natural conditions, and the magnitude of the remaining risks is low given the lack of MGP-related contaminant concentrations in Glen Cove Creek and soil vapor samples. This alternative makes an effort towards removing free-phase NAPL from the subsurface, thus further reducing the source of groundwater contamination. Over time, natural attenuation will reduce and remediate the soil and groundwater concentrations.

- ***Long-Term Effectiveness and Permanence.*** Over the long term, natural attenuation processes are effective at mitigating the plume and its associated risks. Recovered NAPL represents the only waste or significant threat, exposure pathway, or risk to the community and environment with this alternative. Recovered NAPL that is stored on site will be stored in an appropriate container until it is transported off site for disposal. Based on information in the RI, there is currently not a significant amount of free-phase NAPL. Therefore, recovery efforts would likely taper off in the long-term. An MNA program is effective and its final results are permanent; however, its duration is difficult to be determined. The planned institutional controls listed in Table 6-1, are readily implementable and reliable. Furthermore, the RAOs can continue to be met in the future by maintaining the institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** Natural attenuation processes of weathering and degradation will eventually reduce toxicity of the residual contamination. As such, the total volume of MGP residuals at the Site can only decrease with time. The NAPL recovery program will enhance on-site control of NAPL migration. Removing free-phase NAPL will also reduce the toxicity, mobility, and/or volume of the MGP-related source material. Recovered NAPL will be treated and remain off site. Long-term monitoring will be required to determine the rate, amount and extent of these reductions.

- ***Short-Term Effectiveness.*** This alternative will not require any intensive construction activity. No potential short-term impacts are expected. The effectiveness of the remedy will be a direct reflection of the ability to implement and manage the institutional controls designed to protect human health and the environment.

- ***Implementability.*** The equipment and monitoring activities required for this alternative are readily implementable.

- ***Cost.*** The estimated cost for long-term monitoring and NAPL recovery is approximately $1.9 Million and is summarized in table B-1.

7.4.3 Alternative 3: Accessible Source Material ("Hot Spot") Removal, Enhanced Bioremediation with Oxygen Injection, MNA, and NAPL Recovery

- ***Overall Protection of Public Health and the Environment.*** This alternative effectively controls the potential exposure pathways by removing shallow accessible MGP-related source material where feasible under the Site constraints; and creating an in-situ aerobic environment that is conducive to stimulating the biodegradation of MGP-related COCs. Monitoring activities performed under an MNA program will help determine if exposure pathways are complete and if exposure frequency is measurable. NAPL recovery will remove free-phase NAPL mass that is contributing to soil and groundwater contamination. In addition, future potential exposures are managed by establishing institutional controls.

  The alternative does achieve each RAO as described below:

  - *Prevent, to the extent practicable, contact with, or ingestion of contaminated groundwater associated with the Site.* Affected groundwater at the Site is not currently used for water supply. The institutional controls implemented with this alternative will prevent future groundwater use.
  - *Prevent, to the extent practicable, the migration of contaminated groundwater from the Site.* The flux of contaminants flowing towards down gradient points will be reduced to the extent practical by removing shallow accessible MGP-related source material, and creating an aerobic treatment zone within its flow path. The bioactivity stimulated by this aerobic environment will reduce and control the migration of contaminated groundwater from the Site. As stated in the RI, the groundwater plume is stable and believed to be attenuating under natural processes. This alternative would enhance those processes and implement a monitoring program to measure and ensure attenuation processes are progressing.

- *Remove, to the extent practicable, the source of groundwater contamination.* This alternative removes shallow contaminant source areas where accessible and treats the associated groundwater plume from the deeper material left at the Site, to the extent practical under the Site constraints. In addition, free-phase NAPL is removed and disposed off site at an appropriate facility. In addition to shallow source removal, free-phase NAPL removals will ultimately reduce the groundwater contamination. The oxygen injection system will enhance the natural attenuation processes observed at the Site, and will therefore mitigate the rest.
- *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Under current site conditions as stated in the RI, ingestion/direct contact with soil contaminated with MGP-related COCs is not a risk and would be mitigated under imposed institutional controls.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By removing shallow accessible MGP-related source material where feasible under site constraints, and addressing or controlling the exposure pathways, the alternative complies with the SCGs as described in Section 4. This alternative removes accessible shallow accessible MGP-related source material and provides an in-situ treatment of the groundwater impacts from the residual impacts. As stated in the RI, the groundwater plume is stable and appears to be attenuating under natural conditions, and the magnitude of the remaining risks is low given the lack of MGP-related contaminant concentrations in Glen Cove Creek and soil vapor samples.

- ***Long-Term Effectiveness and Permanence.*** Over the long term, natural attenuation processes are effective at mitigating the plume and its associated risks. Removing shallow accessible MGP-related source material will reduce the contaminant flux from the MGP-related source material that is contributing to shallow groundwater contamination, and ultimately augment the attenuation processes. The oxygen injection system will actively treat contaminants migrating from the Site; and will further enhance and promote the natural attenuation processes currently observed at the Site and down gradient. Implementing both technologies will reduce the duration of the natural attenuation processes. Recovered NAPL that is stored on site represents the only waste or significant threat, exposure pathway, or risk to the community and environment with this alternative. Recovered NAPL will be stored in a secondary contained facility until it is safely transported off site for disposal. Based on information in the RI, there is currently not a significant amount of free-phase NAPL. Therefore, recovery efforts would likely taper off in the long-term. The planned institutional controls listed in Table 6-1, are readily implementable and reliable.

Furthermore, the RAOs can continue to be met in the future by maintaining the institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** This alternative removes, stabilizes, and reduces the toxicity, mobility, and volume of the contaminated soil and groundwater by removing shallow accessible MGP-related source material and treating the groundwater prior to migrating off the Site. Off-site destruction of excavated soils and recovered NAPL will reduce the toxicity, mobility and volume significantly. The enhanced natural attenuation processes of weathering and degradation will further reduce the toxicity of the residual contamination. As such, the total volume of MGP residuals at the Site can only decrease with time. Shallow source area removal coupled with the oxygen injection technology will also reduce groundwater concentrations and enhance on-site control of NAPL migration. Recovered NAPL will be removed and treated off site. Long-term monitoring will be required to determine the rate, amount and extent of these reductions.

- ***Short-Term Effectiveness.*** This alternative will require extensive construction activity to accommodate excavation activities and earth supporting structures. This alternative will require some minor intrusive activities inside of the current footprint of the LIPA substation. In addition, construction activities will include the installation of injection points, conveyance piping, treatment system (oxygen generator), NAPL recovery equipment and its secondary containment facility. The Site would need slight modifications, such as clearing, grubbing, and re-grading, to accommodate construction and remediation equipment.

- ***Implementability.*** The excavation and shoring techniques, oxygen injection system and components, NAPL recovery equipment, and the monitoring activities required for this alternative are readily implementable.

- ***Cost.*** The estimated cost for this alternative is approximately $4.9 Million and is summarized in table B-2.

7.4.4 Alternative 4: Restoration to Pre-Release Conditions

- ***Overall Protection of Public Health and the Environment.*** This alternative effectively controls the potential exposure pathways by removing all of the MGP-related source material without any site constraints. Temporary monitoring activities will help determine if exposure pathways are complete and if exposure frequency is measurable. In addition, future potential exposures are managed by establishing institutional controls.

The alternative does achieve each RAO as described below:

- *Prevent, to the extent practicable, contact with, or ingestion of contaminated groundwater associated with the Site.* Affected groundwater at the Site is not currently used for water supply. The institutional controls implemented with this alternative will prevent future groundwater use.

- *Prevent, to the extent practicable, the migration of contaminated groundwater from the Site.* The migration of contaminated groundwater from the Site will be eliminated with this alternative. As stated in the RI, the groundwater plume is stable and believed to be attenuating under natural processes. Any residual contamination in the off-site areas would likely degrade much quicker; and therefore, a monitoring program would be enacted to measure and ensure attenuation processes are progressing.

- *Remove, to the extent practicable, the source of groundwater contamination.* This alternative removes all on-site contaminant MGP-related source material and the material is disposed off site at an appropriate facility.

- *Prevent, to the extent practicable, ingestion/direct contact with contaminated soil.* Under current site conditions as stated in the RI, ingestion/direct contact with soil contaminated with MGP-related COCs is not a risk and would be mitigated under imposed institutional controls. Under this alternative, all impacted material is removed and there is no future need for institutional controls for soil.

- ***Compliance with Standards, Criteria, and Guidelines (SCGs).*** By removing all on-site MGP-related source material without site constraints, and eliminating or controlling the exposure pathways, the alternative complies with the SCGs as described in Section 4.

- ***Long-Term Effectiveness and Permanence.*** The magnitude of the remaining risks is minimal given the removal of all the on-site MGP-related source material. Any remaining risks are mitigated through the planned institutional controls listed in Table 6-1, which are readily implementable and reliable. Furthermore, the RAOs can continue to be met in the future by maintaining the institutional controls.

- ***Reduction of Toxicity, Mobility, or Volume with Treatment.*** This alternative reduces the toxicity, mobility, and volume of the contaminated soil and groundwater by excavated all on-site MGP-related source material and destroying it off site at an appropriate facility.

- ***Short-Term Effectiveness.*** This alternative will require extensive construction activity to accommodate dewatering activities, earth-supporting structures, termination and disposal of the LIPA substation, and waste transportation vehicles.

- ***Implementability.*** This alternative is not implementable at the Site. Although the excavation and demolition techniques required for this alternative are readily implementable, this alternative would require the shutdown and removal of the active substation.

- ***Cost.*** The estimated cost for long-term monitoring and NAPL recovery is approximately $33.5 Million and is summarized in table B-3.

8. Recommended Remedy

Alternative 3 is the recommended remedy. Alternative 3 will achieve the Remedial Action Objectives for the Site through a combination of shallow hotspot removal of MGP-related material, groundwater treatment via oxygen injection, NAPL recovery, monitored natural attenuation and institutional controls. Removing shallow accessible MGP-related source material will reduce the ongoing contaminant mass flux into the groundwater. NAPL recovery will also reduce the contaminant mass. The oxygen injection system will then treat the residual groundwater plume prior to its migrating off site and enhance the natural attenuation process observed on site and down gradient during the Remedial Investigation.

This alternative will not immediately return the Site to pre-release conditions as in Alternative 4. However, completion of Alternative 3 will eventually achieve similar results as complete removal without the risk of interrupting electrical service, at substantially less the disruption to the community required to return the Site to pre-release conditions. Furthermore, implementing Alternative 3 will eliminate and control exposure pathways to site contaminants as effectively as would Alternative 4. Any additional removal potentially achieved through Alternative 4 will not create a condition that is substantially more protective of human health and the environment. Returning the Site to pre-release conditions would require demolition of the important LIPA substation, and extensive construction dewatering activities and substantive excavation support structures. These activities would create serious disruptions to the community as well as the risk of a loss of electrical service to a broader area. In addition, it would be a more costly alternative, with as noted, no incremental improvement in environmental health and safety.

The recommended alternative will include the following:

- Removal of shallow accessible MGP-related source material and off-site thermal treatment. This will reduce the contaminant mass and reduce the contaminant flux of contaminants into the groundwater from the Site.

- An oxygen injection system will treat the residual contaminant plume prior to its migration off site. Furthermore, this type of system will enhance the natural attenuation process currently observed on and off site.

- NAPL recovery activities when warranted.

- Regular monitoring of the natural attenuation processes.

- Implementation of a Community Air Monitoring Program (CAMP) during remedial construction activities.

- Development and implementation of a Site Management Plan (SMP). The SMP would identify the institutional controls and engineering controls (IC/ECs) required to maintain the remedial alternative and manage potential risks related to possible future site activities or property development. These will include, but is not limited to:

  - Procedures to manage the remaining contaminated soils regarding potential site development (i.e. soil characterization, handling, health and safety of workers and the community protocol, disposal/reuse requirements in accordance with applicable NYSDEC regulations and procedures);
  - Criteria to evaluate the potential for vapor intrusion for any future buildings developed on the Site, including mitigation of any impacts identified;
  - Institutional controls to maintain use restrictions regarding site groundwater use identified in the environmental easement;
  - The schedule and requirements for the Institutional Control/ Engineering Control (IC/EC) certifications;
  - An operation and maintenance plan to provide the detailed procedures necessary to operate and maintain the groundwater treatment system, and NAPL recovery activities;
  - Performance metrics to monitor the effectiveness of the groundwater treatment system, NAPL recovery activities, and the natural attenuation process on site;
  - Natural attenuation monitoring activities;
  - Monitoring requirements for groundwater down gradient from the Site and the sediment and surface water in Glen Cove Creek; and
  - Closure requirements for the remedial alternative. The operation of the components of the remedy would continue until the remedial objectives have been achieved, or until the NYSDEC determines that continued operation is technically impracticable or not feasible.

The IC/ECs described above are required to prevent and control potential exposure to remaining contaminants during and after implementation of the recommended alternative. These controls are straightforward and readily implementable. Furthermore, they will reliably prevent potential exposures. Future disturbance of remaining zones of contamination will be infrequent and unlikely if the LIPA substation remains in service as designed. As previously stated, the water supply at the Site does not currently use groundwater. Implementing an institutional control that restricts groundwater use on and immediately off site will help ensure that this potential exposure does not occur. These IC/ECs will also memorialize prescribed methods and protocols for managing work, groundwater, and soils during any future routine excavation activity. With proper and responsible implementation of the SMP, this remedy will support a variety of potential future land uses should the land be re-developed.

Prior to implementing the remedy, many issues and details related to the design and specifications of the remedy will be resolved in the upcoming design phase. The design process will identify and resolve issues related to the exact physical limits of excavation within the hot spots identified; and the project's impact on the local community during implementation (i.e. dust and odor control, and potential temporary utility relocation). Pilot-scale testing of the oxygen injection technology will determine its operating parameters and finalize the location and alignment of the oxygen injection points. Furthermore, National Grid is utilizing the oxygen injection technology at similar sites. Therefore, the results and experience from those applications will help develop the pilot test, system design, and the performance monitoring requirements for this site. While not anticipated, property access and occupancy issues will also be identified during the design phase.

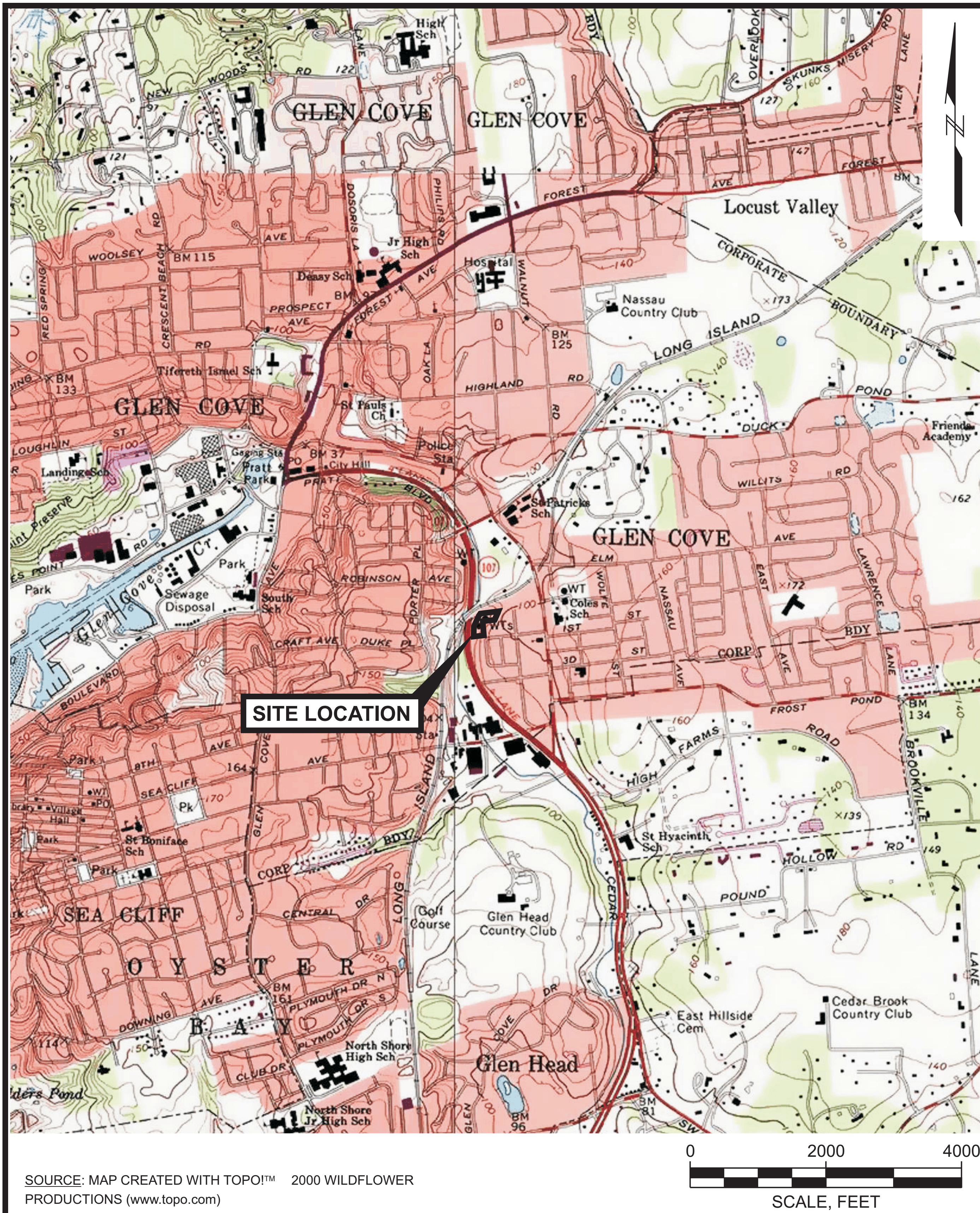
8.1 Remedial Schedule and Implementation

The current property owner, Long Island Power Authority, is planning to conduct a facility upgrade beginning in September 2010. The upgrade will include the installation of underground utilities and foundations. LIPA has requested that the hot spot excavation activities be performed prior to the upgrade. Once the new facilities are in place, we will be restricted from excavation in these areas. Therefore, National Grid requests approval to perform the excavation of the hot spots as an interim remedial measure (IRM) in advance of the formal remedy approval. LIPA has emphasized that they will not permit remedial work during the summer of 2010 as this is the period when the need for optimal substation operation is the most critical. Therefore, this proposed IRM will be conducted during the spring of 2010 and completed prior to the facility upgrade work. The following milestone schedule is provided in anticipation of approval of this approach. This schedule is dependant on construction to be performed by the property owner and may change based on access relative to the owner's new construction.

Milestone	Date
Submit Draft RAP	Nov 2009
Submit Final RAP	Jan 2010
NYSDEC RAP Approval	Feb 2010
Submit Draft Excavation IRM Work Plan	Jan 2010
Submit Final IRM Work Plan	Jan 2010
IRM Mobilization	Mar 2010
IRM Field Work	Mar 2010-Jun 2010
Submit Draft RAWP	Apr 2010
Submit Final RAWP	May 2010
RAWP Mobilization	Jul 2010*
Oxygen Injection System Installation	Jul 2010-Sep 2010*
Submit Final Engineering Report	Nov 2010

*The exact date for the installation of the oxygen injection system will be based on the completion of substation construction activities.

Figures



SOURCE: MAP CREATED WITH TOPO!™ 2000 WILDFLOWER PRODUCTIONS (www.topo.com)

REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
GLEN COVE, NEW YORK

nationalgrid

GEI Consultants

Project 093270-2-1201

SITE LOCATION MAP

March 2010

Figure 1-1

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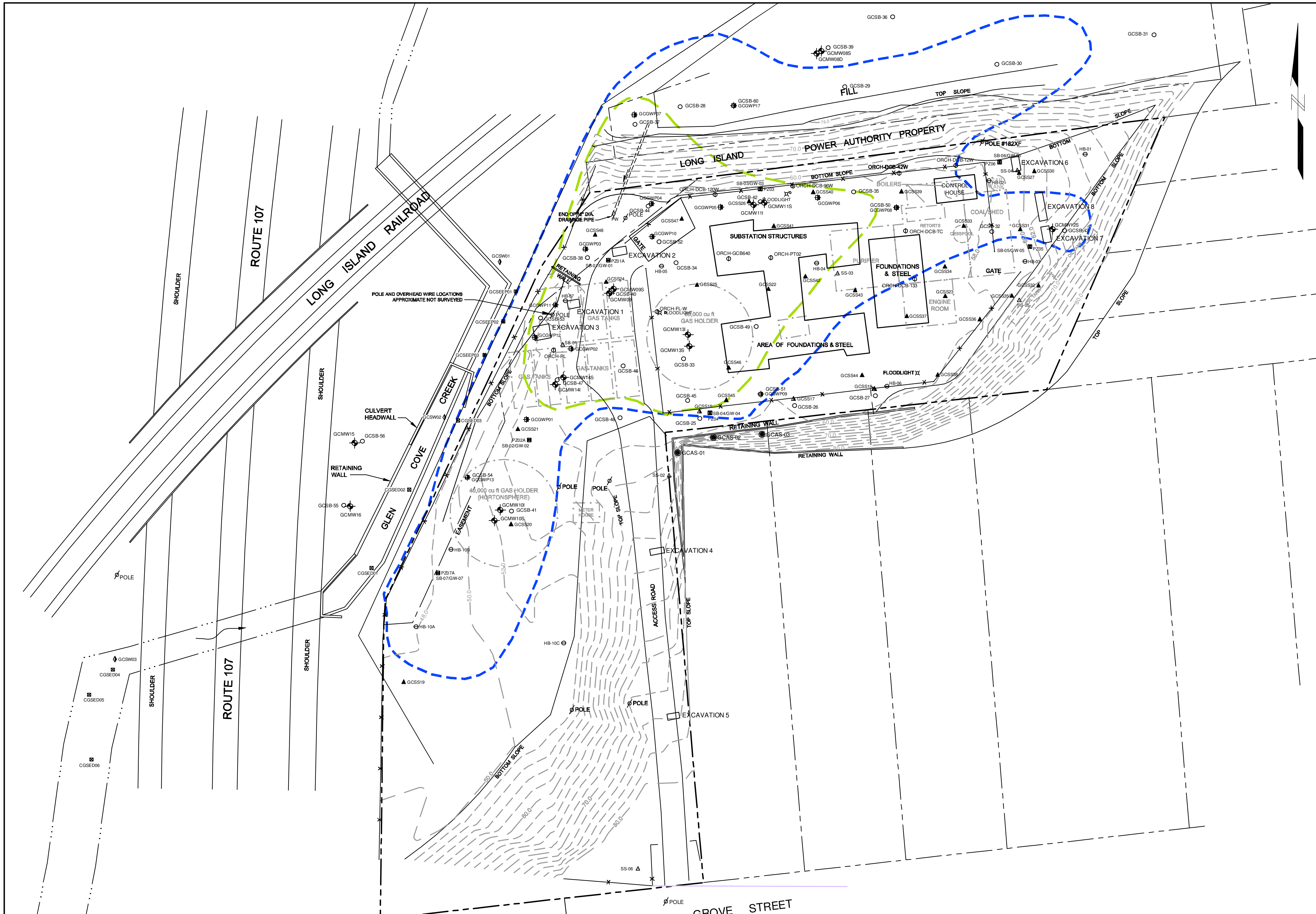

LEGEND:

PROPERTY BOUNDARY
EXISTING STRUCTURE
HISTORIC STRUCTURE
SURFACE ELEVATION CONTOUR
CREEK
FENCE
GCMW12S — MONITORING WELL LOCATION (PS&S)
GCGWP14 — GEOPROBE ® GROUNDWATER PROBE LOCATION (PS&S)
PZ01A — PIEZOMETER LOCATION (PS&S)
PZ03 — PIEZOMETER LOCATION (GEI)
SB-01/GW-01 — SOIL BORING CONVERTED TO PIEZOMETER (GEI)
ORCH-FL-W — SOIL BORING LOCATION (KEYSPAN)
GCGWP01 — GEOPROBE ® BORING LOCATION (PS&S)
GCSB-25 — SUBSURFACE SOIL SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
HB-01 — HAND BORING SOIL SAMPLE LOCATION (GEI)
GCSS20 — SURFACE SOIL SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
SS-01 — SURFACE SOIL SAMPLE LOCATION (GEI)
GCSS19 — SURFACE SOIL SAMPLE LOCATION (PS&S)
CGSED01 — SEDIMENT SAMPLE LOCATION (PS&s)
GCSEEP01 — SEEP SAMPLE LOCATION (PS&S)
GCSW01 — SURFACE WATER SAMPLE LOCATION (PS&S)
GCAS-01 — ASH SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
EXCAVATION 5 — EXCAVATION LOCATION (DVIRKA AND BARTILUCCI)
OBSERVED EXTENT OF VISUAL IMPACTS IN SOIL INCLUDING BLEBS, GLOBS, LENSES, GRAIN COATING, SHEENS, STAINED AND SOLID TAR
OBSERVED EXTENT OF VISUAL IMPACTS OF TAR/NAPL IN SOIL

SOURCE:

PLAN BASED ON *DRAWING 1: INTERPRETED LATERAL EXTENT OF SOIL AND GROUNDWATER IMPACTS,* PREPARED BY PS&S, SCALE: 1" = 25', DATE: 9/4/07.

REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
GLEN COVE, NEW YORK

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SITE PLAN

Project 093270-2-1201	March 2010	Figure 2-1

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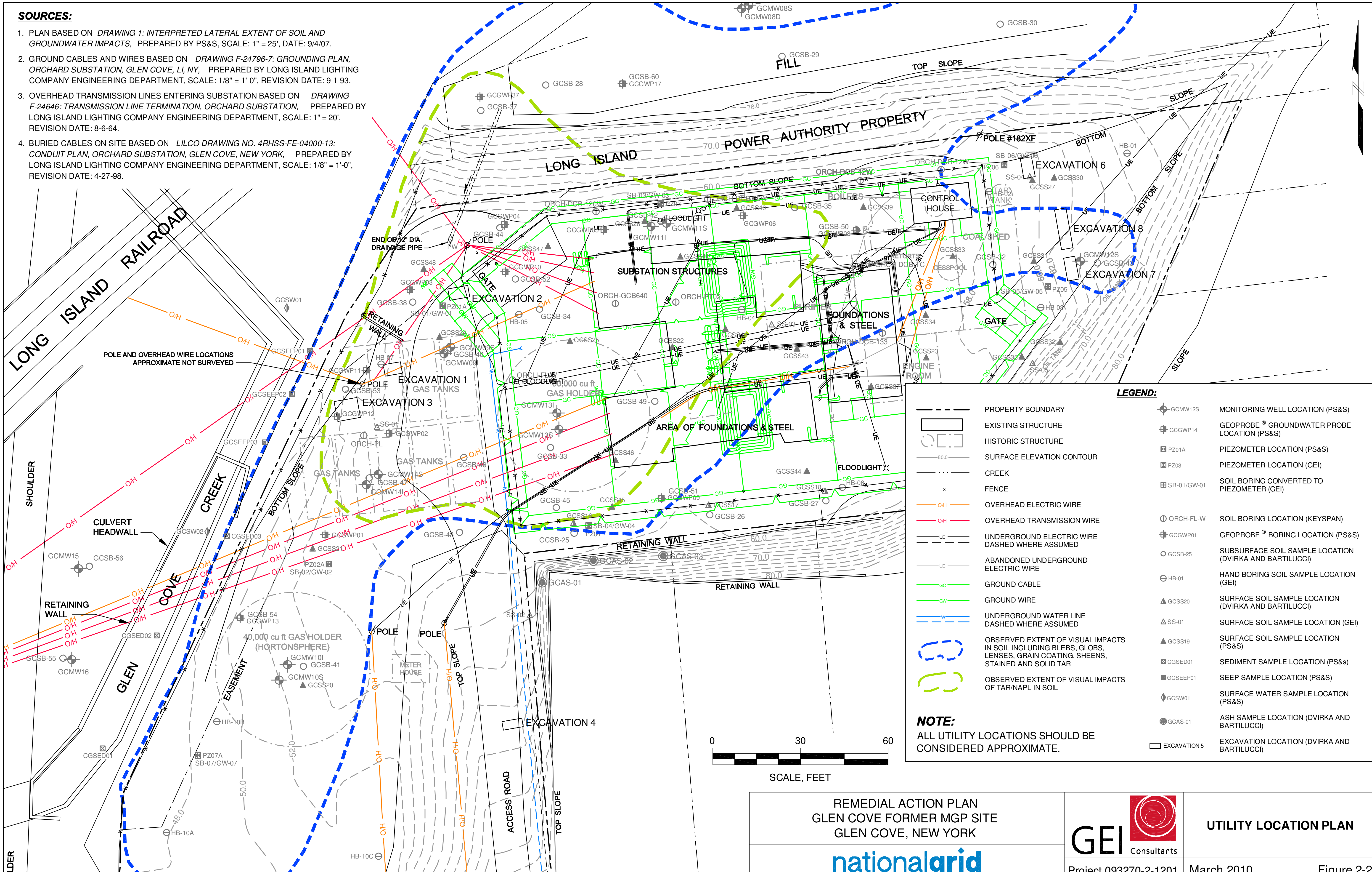
SOURCES:

1. PLAN BASED ON *DRAWING 1: INTERPRETED LATERAL EXTENT OF SOIL AND GROUNDWATER IMPACTS,* PREPARED BY PS&S, SCALE: 1" = 25', DATE: 9/4/07.
2. GROUND CABLES AND WIRES BASED ON *DRAWING F-24796-7: GROUNDING PLAN, ORCHARD SUBSTATION, GLEN COVE, LI, NY,* PREPARED BY LONG ISLAND LIGHTING COMPANY ENGINEERING DEPARTMENT, SCALE: 1/8" = 1'-0", REVISION DATE: 9-1-93.
3. OVERHEAD TRANSMISSION LINES ENTERING SUBSTATION BASED ON *DRAWING F-24646: TRANSMISSION LINE TERMINATION, ORCHARD SUBSTATION,* PREPARED BY LONG ISLAND LIGHTING COMPANY ENGINEERING DEPARTMENT, SCALE: 1" = 20', REVISION DATE: 8-6-64.
4. BURIED CABLES ON SITE BASED ON *LILCO DRAWING NO. 4RHSS-FE-04000-13: CONDUIT PLAN, ORCHARD SUBSTATION, GLEN COVE, NEW YORK,* PREPARED BY LONG ISLAND LIGHTING COMPANY ENGINEERING DEPARTMENT, SCALE: 1/8" = 1'-0", REVISION DATE: 4-27-98.



LEGEND:

PROPERTY BOUNDARY	MONITORING WELL LOCATION (PS&S)
EXISTING STRUCTURE	GEOPROBE ® GROUNDWATER PROBE LOCATION (PS&S)
HISTORIC STRUCTURE	PIEZOMETER LOCATION (PS&S)
SURFACE ELEVATION CONTOUR	PIEZOMETER LOCATION (GEI)
CREEK	SOIL BORING CONVERTED TO PIEZOMETER (GEI)
FENCE	
OVERHEAD ELECTRIC WIRE	SOIL BORING LOCATION (KEYSPAN)
OVERHEAD TRANSMISSION WIRE	GEOPROBE ® BORING LOCATION (PS&S)
UNDERGROUND ELECTRIC WIRE DASHED WHERE ASSUMED	SUBSURFACE SOIL SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
ABANDONED UNDERGROUND ELECTRIC WIRE	HAND BORING SOIL SAMPLE LOCATION (GEI)
GROUND CABLE	SURFACE SOIL SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
GROUND WIRE	SURFACE SOIL SAMPLE LOCATION (GEI)
UNDERGROUND WATER LINE DASHED WHERE ASSUMED	SURFACE SOIL SAMPLE LOCATION (PS&S)
OBSERVED EXTENT OF VISUAL IMPACTS IN SOIL INCLUDING BLEBS, GLOBS, LENSES, GRAIN COATING, SHEENS, STAINED AND SOLID TAR	SEDIMENT SAMPLE LOCATION (PS&S)
OBSERVED EXTENT OF VISUAL IMPACTS OF TAR/NAPL IN SOIL	SEEP SAMPLE LOCATION (PS&S)
	SURFACE WATER SAMPLE LOCATION (PS&S)
	ASH SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
	EXCAVATION LOCATION (DVIRKA AND BARTILUCCI)

NOTE:
ALL UTILITY LOCATIONS SHOULD BE CONSIDERED APPROXIMATE.

0 30 60
SCALE, FEET

REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
GLEN COVE, NEW YORK

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UTILITY LOCATION PLAN

Project 093270-2-1201 | March 2010 | Figure 2-2

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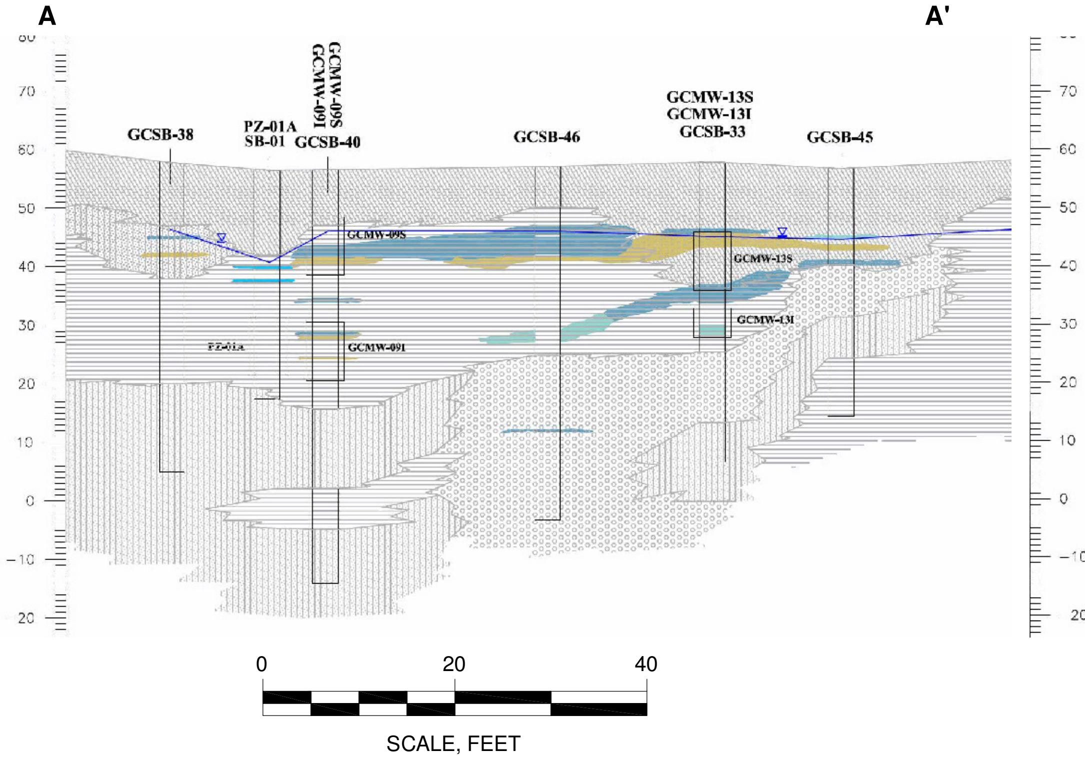
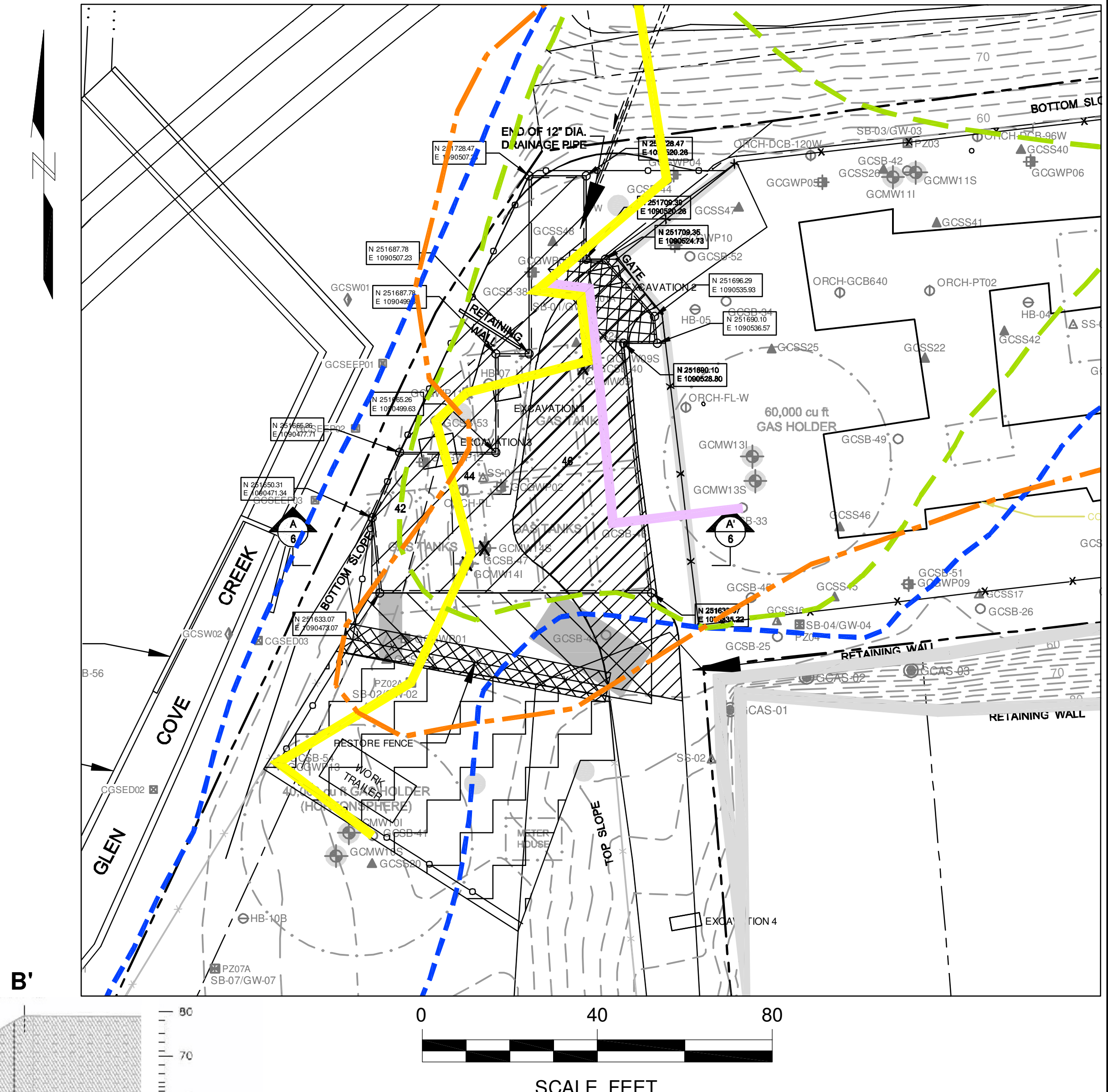


CROSS SECTION LEGEND:

- FILL
- SAND AND GRAVEL
- SILTY SAND
- SILTY CLAY
- INTERLAYERED SAND WITH GRAVEL
- TAR/NAPL SATURATED
- BLEBS, SHEENS, LENSES, GLOBES
- STAINED
- SOLID TAR
- WATER TABLE
- WELL SCREEN INTERVAL

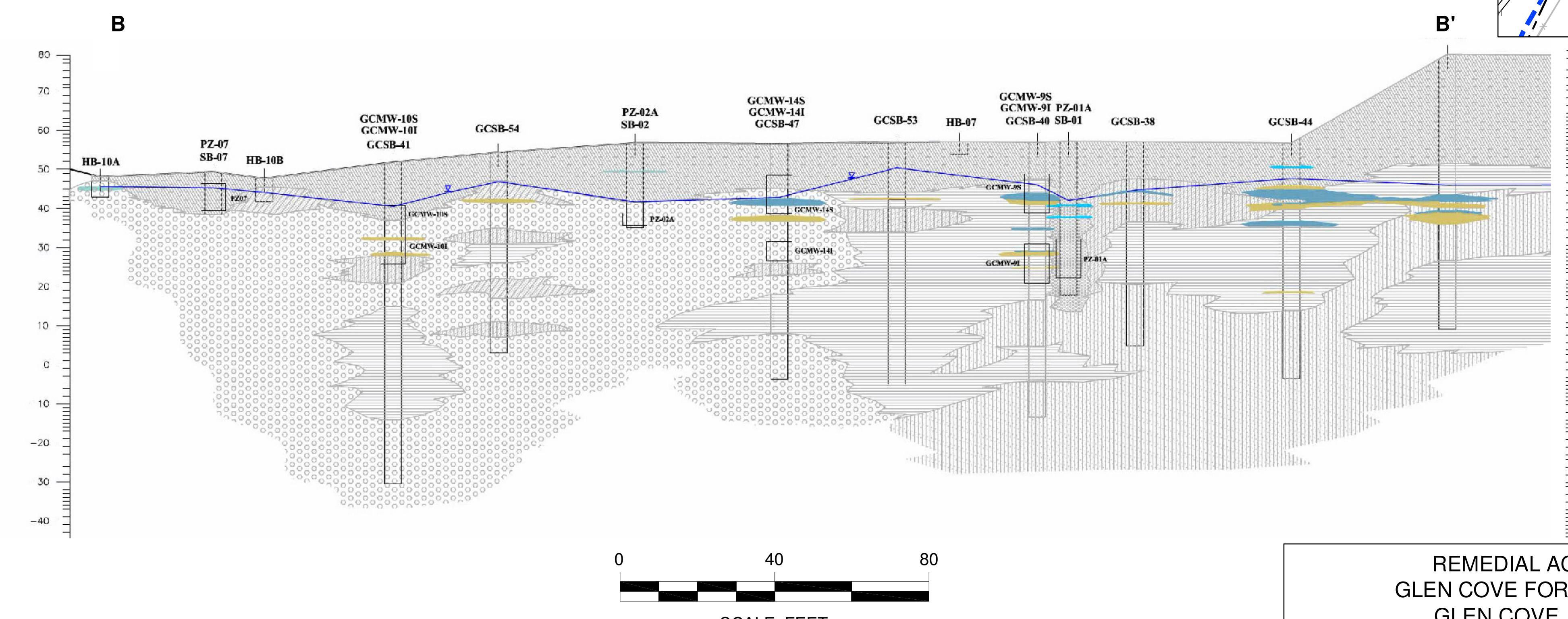


PLAN LEGEND:

- A — A' SECTION A-A'
- B — B' SECTION B-B'
- OBSERVED EXTENT OF VISUAL IMPACTS IN SOIL INCLUDING BLEBS, GLOBS, LENSES, GRAIN COATING, SHEENS, STAINED AND SOLID TAR
- OBSERVED EXTENT OF VISUAL IMPACTS OF TAR/NAPL IN SOIL
- APPROXIMATE HORIZONTAL EXTENT OF MGP RELATED DISSOLVED PHASE CONSTITUENTS

NOTES:

1. A-A' IS EXCERPT FROM *FIG3A GEOLOGIC CROSS SECTION A-A'* DATED 6/12/06 PREPARED BY PS&S FOR NOVEMBER 2008 RI REPORT.
2. B-B' IS EXCERPT FROM *FIG3B GEOLOGIC CROSS SECTION B-B'* DATED 6/12/06 PREPARED BY PS&S FOR NOVEMBER 2008 RI REPORT.



REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
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GEOLOGIC CROSS SECTIONS

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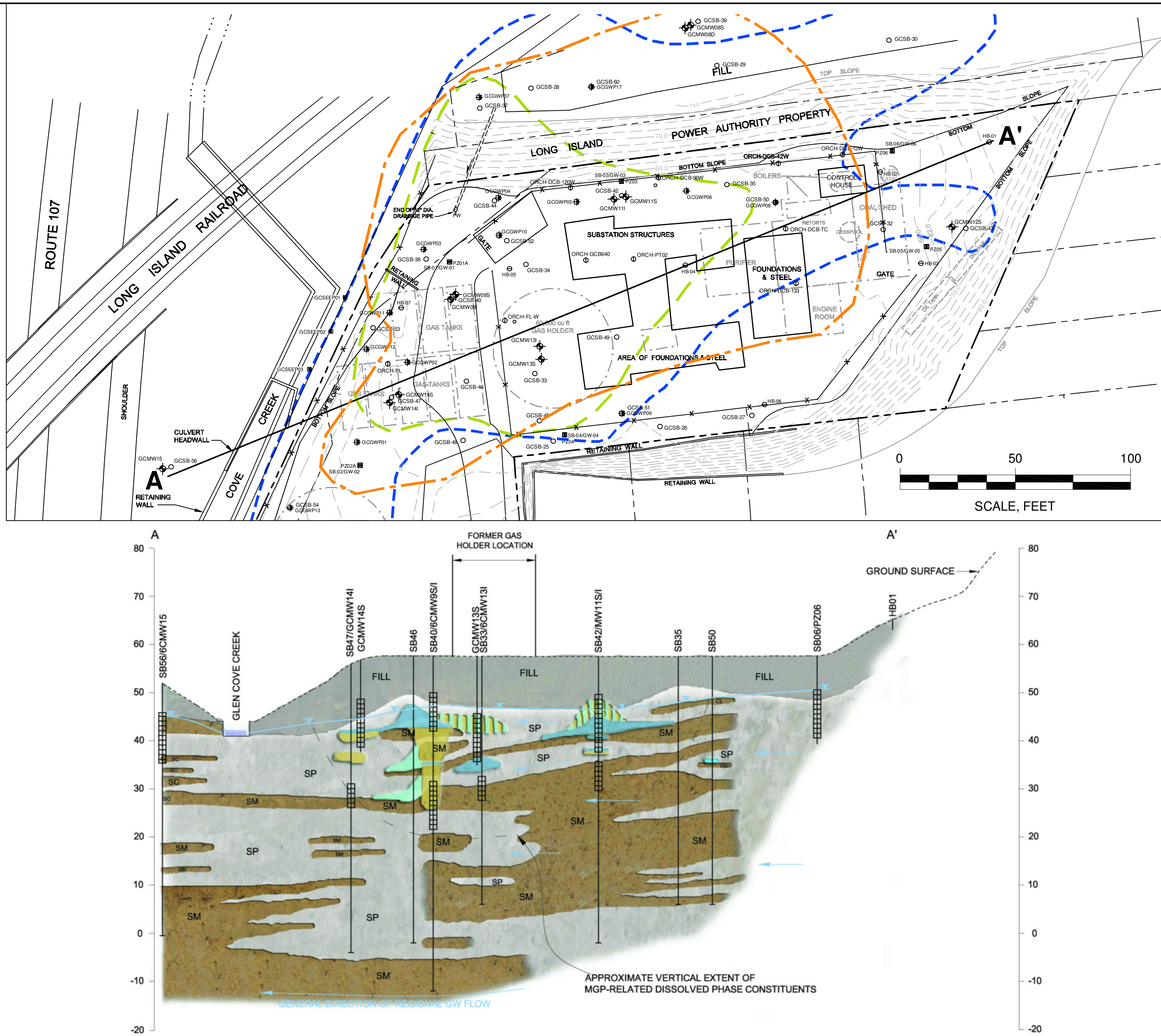

CROSS SECTION LEGEND:

- FILL
- SP=POORLY GRADED SAND, GRAVELLY SAND
- SM, CL, SC=SILTY SAND, CLAYEY SAND
- GROUNDWATER TABLE
- GROUNDWATER FLOW DIRECTION
- SOLID TAR
- TAR SATURATED
- BLEBS
- BLEBS AND STAINED
- STAINED
- SOIL BORING/ MONITORING WELL
- WELL SCREEN INTERVAL

SITE PLAN LEGEND:

- GCMW12S — MONITORING WELL LOCATION (PS&S)
- GCGWP14 — GEOPROBE ® GROUNDWATER PROBE LOCATION (PS&S)
- PZ01A — PIEZOMETER LOCATION (PS&S)
- PZ03 — PIEZOMETER LOCATION (GEI)
- SB-01/GW-01 — SOIL BORING CONVERTED TO PIEZOMETER (GEI)
- MONITORING POINT (PS&S)
- ORCH-FL-W — SOIL BORING LOCATION (KEYSPAN)
- GCGWP01 — GEOPROBE ® BORING LOCATION (PS&S)
- GCSB-25 — SUBSURFACE SOIL SAMPLE LOCATION (DVIRKA AND BARTILUCCI)
- HB-01 — HAND BORING SOIL SAMPLE LOCATION (GEI)
- CGSED01 — SEDIMENT SAMPLE LOCATION (PS&s)
- GCSEEP01 — SEEP SAMPLE LOCATION (PS&S)
- OBSERVED EXTENT OF VISUAL IMPACTS IN SOIL INCLUDING BLEBS, GLOBS, LENSES, GRAIN COATING, SHEENS, STAINED AND SOLID TAR
- OBSERVED EXTENT OF VISUAL IMPACTS OF TAR/NAPL IN SOIL
- APPROXIMATE HORIZONTAL EXTENT OF MGP RELATED DISSOLVED PHASE CONSTITUENTS

SOURCES:

1. PLAN BASED ON *DRAWING 1: INTERPRETED LATERAL EXTENT OF SOIL AND GROUNDWATER IMPACTS,* PREPARED BY PS&S, SCALE: 1" = 25', DATE: 9/4/07.
2. CROSS SECTION FROM: *DRAWING NO. 6A: SITE CONCEPTUAL MODEL,* PREPARED BY PS&S, HORIZONTAL SCALE: 1" = 25', VERTICAL: 1"=10', DATE: 03-0608.

REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
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SITE CONCEPTUAL MODEL

Project 093270-2-1201 | March 2010 | Figure 3-2

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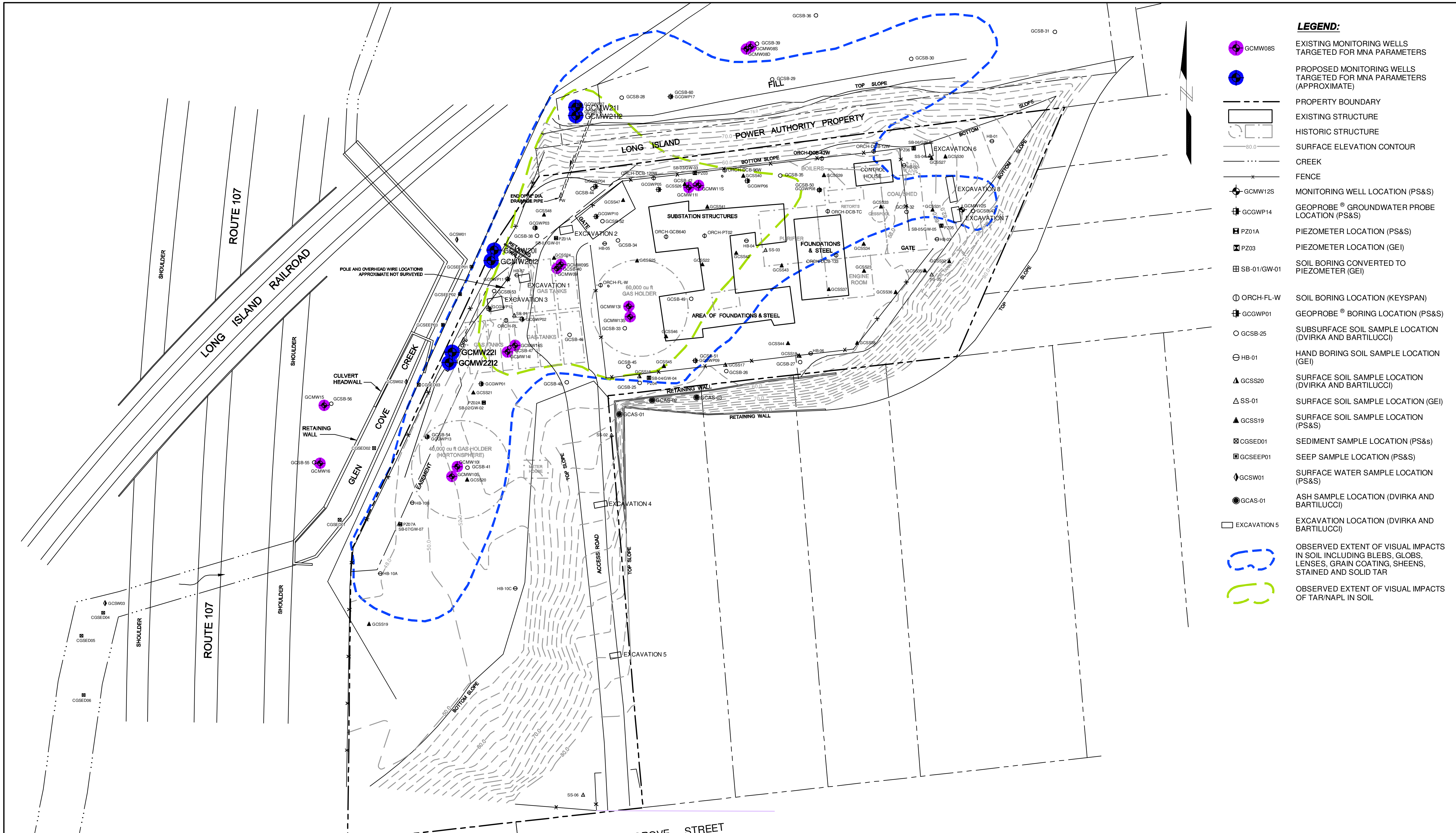

SOURCE:

PLAN BASED ON *DRAWING 1: INTERPRETED LATERAL EXTENT OF SOIL AND GROUNDWATER IMPACTS,* PREPARED BY PS&S, SCALE: 1" = 25', DATE: 9/4/07.

0 50 100

SCALE, FEET

REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
GLEN COVE, NEW YORK

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REMEDIAL ALTERNATIVE 2

Project 093270-2-1201 | March 2010 | Figure 7-1

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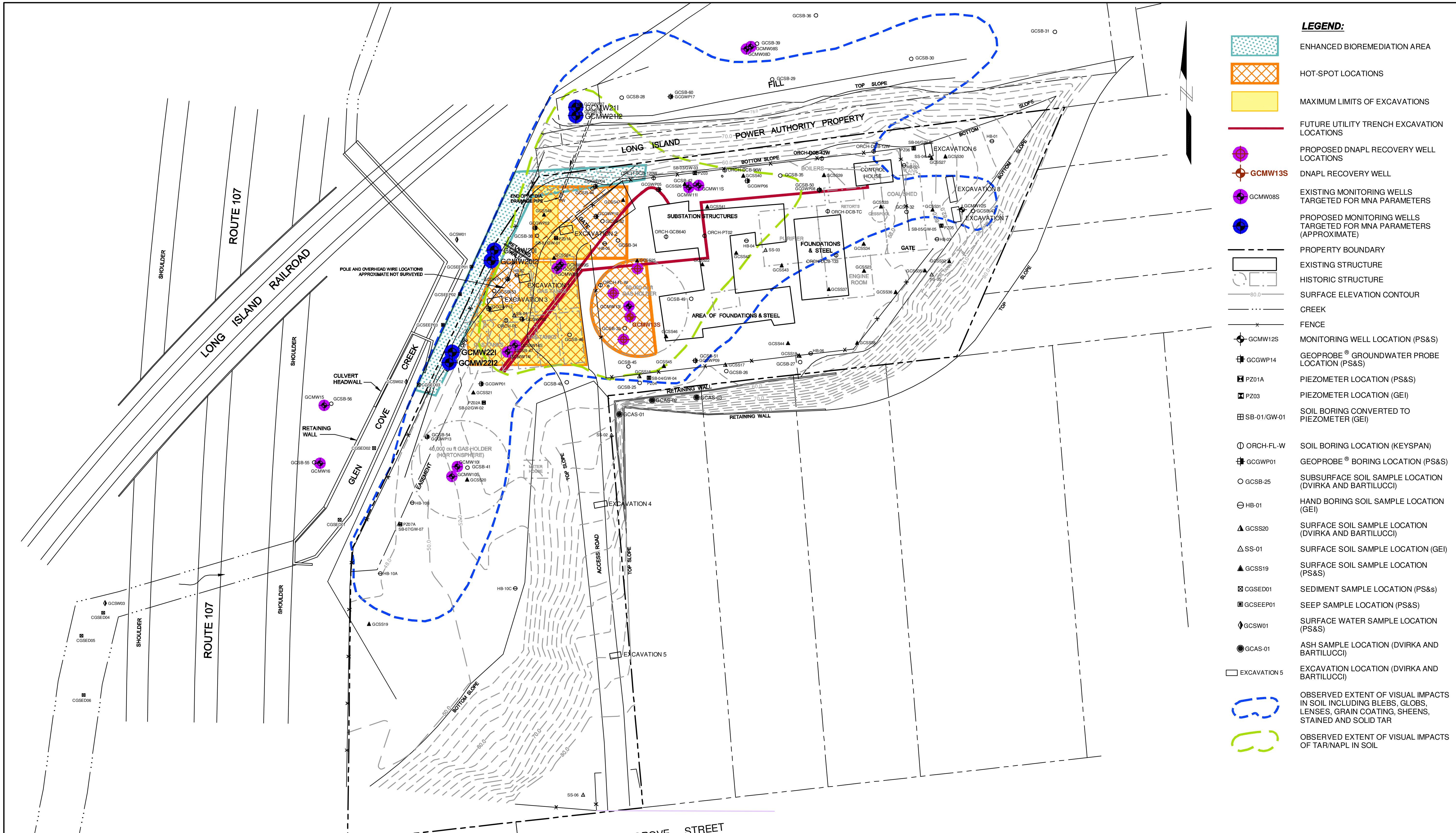

SOURCE:

PLAN BASED ON *DRAWING 1: INTERPRETED LATERAL EXTENT OF SOIL AND GROUNDWATER IMPACTS,* PREPARED BY PS&S, SCALE: 1" = 25', DATE: 9/4/07.

0 50 100

SCALE, FEET

REMEDIAL ACTION PLAN
GLEN COVE FORMER MGP SITE
GLEN COVE, NEW YORK

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REMEDIAL ALTERNATIVE 3

Project 093270-2-1201 | March 2010 | Figure 7-2

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Appendix A

Contaminant Mass Estimate by Depth Interval and Site Area

Table A-1
Contaminant Mass Estimate by Depth Interval and Site Area
Glen Cove Former MGP Site
Glen Cove, New York

Depth Below Site Grade (feet)	Estimated Area of Impacts (SF)	Impacted Layer Thickness (feet)	Impacted Layer Volume (Cubic Feet)	Impacted Layer Volume (Cubic Yard)	Mass of Contaminants (lbs)	% of Total Mass
Surface and subsurface soils above 7 ft were not used in calculating total mass at site.	13,184.5	6	79,107.1	2,929.9	174,513	84.1
For GCSB-25 through GCSB-31 no data could be found for Total VOCs, so the value used for Total VOCs equals Total BTEX.	19,111.8	6	114,670.8	4,247.1	10,081	4.9
19-25	4,586.0	6	27,516.0	1,019.1	8,398	4.0
25-31	2,177.0	6	13,062.0	483.8	5,891	2.8
31-37	10,179.3	6	61,075.9	2,262.1	7,127	3.4
37-43	8,708.5	6	52,251.0	1,935.2	1,447	0.7
43-45.5	1,756.4	2.5	4,391.0	162.6	13	0.006
Total	**59,703.5**	**38.5**	**352,073.8**	**13,039.8**	**207,470**	**100.0**

Removal of Gas Holder		
Excavation Depth	**Mass Removed (lbs)**	**% of total removed**
7-13 ft	73.1	0.04
13-19 ft	73.1	0.04
19-25 ft	820.5	0.40
25-31 ft	687.3	0.33
31-37 ft	257.2	0.12
37-43 ft	0.0	0.00
43-45.5 ft	0.9	0.00
Total	**1,912.0**	**0.92**

Removal of Gas Tanks		
Excavation Depth	**Mass Removed (lbs)**	**% of total removed**
7-13 ft	29,155.5	14.05
13-19 ft	233.1	0.11
19-25 ft	418.1	0.20
25-31 ft	3,130.9	1.51
31-37 ft	868.2	0.42
37-43 ft	0.0	0.00
43-45.5 ft	9.7	0.00
Total	**33,815.5**	**16.3**

Removal of Northwest Parcel		
Excavation Depth	**Mass Removed (lbs)**	**% of total removed**
7-13 ft	18,813.7	9.07
13-19 ft	3,836.9	1.85
19-25 ft	508.7	0.25
25-31 ft	500.6	0.24
31-37 ft	208.9	0.10
37-43 ft	0.4	0.00
43-45.5 ft	0.0	0.00
Total	**23,869.2**	**11.5**

Removal of all 3 Areas		
Excavation Depth	**Mass Removed (lbs)**	**% of total removed**
7-13 ft	48,042.3	23.16
13-19 ft	4,143.1	2.00
19-25 ft	1,747.3	0.84
25-31 ft	4,318.9	2.08
31-37 ft	1,334.3	0.64
37-43 ft	0.4	0.00
43-45.5 ft	10.6	0.01
Total	**59,596.8**	**28.7**

Table A-1
Contaminant Mass Estimate by Depth Interval and Site Area
Glen Cove Former MGP Site
Glen Cove, New York

Assumptions:

Surface and subsurface soils above 7 ft were not used in calculating total mass at site.
For GCSB-25 through GCSB-31 no data could be found for Total VOCs, so the value used for Total VOCs equals Total BTEX.
If analytical data for any soil borings contained a "B" qualifier, the exact value that appeared in the laboratory report was used.
dtw (depth to water) values were taken from soil boring records. When no boring was available, a dtw was taken from an adjacent boring or groundwater contours.
An "impacted interval" is a 6 foot soil interval that has been observed to have visual impacts anywhere within that interval.
Intervals chosen for these calculations are 7-13 ft below ground surface (bgs), 13-19 ft bgs, 19-25 ft bgs, 25-31 ft bgs, 31-37 ft bgs, 37-43, and 43-45.5 ft bgs.
Visual impacts do not occur more than 45.5 ft bgs, so the deepest interval is 2.5 ft thick from 43 to 45.5 ft bgs.
The impacted areas' boundaries have not been mathematically determined. They have been drawn approximately half way between impacted and non-impacted borings.
Shapes of impacted areas have been simplified for calculation purposes.
Soil borings which have visual impacts but no analytical data for that interval was assumed to have a concentration equal to the average concentration from surrounding borings which contained similar impacts.
Areas with no visual impacts are assumed to have a zero concentration and therefore do not contribute any contaminant mass to the site.

Appendix B

Remedial Alternative Cost Estimates

Table B-1
Opinion of Cost for Remedial Alternative 2
Glen Cove Former MGP Site
Glen Cove, New York

GEI Consultants, Inc. (GEI) has prepared this opinion of cost required to complete remediation of the Glen Cove former MGP site. GEI's opinion is based on published RS Means Cost Data, Vendor Costs, and on GEI's project experience. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors (see page 4 of 4 for list of specific assumptions). An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions.

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
Preconstruction				
1 Engineering Design, Plans, Specs, Bid	Lump Sum	$ 65,000	1	$ 65,000
			Subtotal	$ 65,000
			% Total Costs	3%
Construction Management				
1 NAPL Recovery Well Installation Oversight	Day	$ 1,260	20	$ 25,200
2 Air Monitoring during construction	Day	$ 740	20	$ 14,800
3 Air Monitoring System	Month	$ 2,950	1	$ 2,950
4 Site Survey (Post-Remediation)	Lump Sum	$ 6,200	1	$ 6,200
			Subtotal	$ 49,150
			% Total Costs	3%
General Conditions				
1 Mobilization/Demobilization	Lump Sum	$ 30,000	1	$ 30,000
2 Site Preparation (Temp fence and shrub removal)	Lump Sum	$ 12,000	1	$ 12,000
			Subtotal	$ 42,000
			% Total Costs	2%
REMEDIAL COMPONENTS				
Monitored Natural Attenuation and NAPL Recovery				
1 NAPL Recovery Well Installation and Monitoring Well Installation	Lump Sum	$ 75,000	1	$ 75,000
			Subtotal	$ 75,000
			% Total Costs	4%
Long Term Groundwater Monitoring				
1 Periodic Monitoring, Reporting, and Disposal (Present Value)	Year	$ 86,000	30	$ 1,322,031
assume discount rate (i)=5%			**800**	$1,322,031
Excavation Support (15 foot depth)		**23.5**	**% Total Costs**	68%
REMEDIAL COST SUMMARY				
Total Capital costs without contingency				$ 231,150
Total O & M costs				$ 1,322,031
Total Capital and O&M costs without contingency				$ 1,553,181
Contingency (25%)			25%	$ 388,295
			830	20%
			TOTAL COST	**$ 1,941,476**

Table B-2
Opinon of Cost for Remedial Alternative 3
Glen Cove Former MGP Site
Glen Cove, New York

GEI Consultants, Inc. (GEI) has prepared this opinion of cost required to complete remediation of the Glen Cove former MGP site. GEI's opinion is based on published RS Means Cost Data, Vendor Costs, and on GEI's project experience. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors (see page 4 of 4 for list of specific assumptions). An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions.

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
Preconstruction				
1 Engineering Design, Plans, Specs, Bid	Lump Sum	$ 200,000	1	$ 200,000
2 Permitting and Regulatory Submittals	Lump Sum	$ 40,000	1	$ 40,000
			Subtotal	$ 240,000
			% Total Costs	5%
Construction Management				
1 Construction Manager	Day	$ 1,260	110	$ 138,600
2 Resident Engineer	Day	$ 1,260	110	$ 138,600
3 Air Monitoring during construction	Day	$ 740	80	$ 59,200
4 Air Monitoring System	Month	$ 17,000	4	$ 68,000
5 Geotechnical and Structural Evaluation and Survey	Lump Sum	$ 45,000	1	$ 45,000
6 Site Survey (Post-Remediation)	Lump Sum	$ 6,200	1	$ 6,200
			Subtotal	$ 455,600
			% Total Costs	9%
General Conditions				
1 Mobilization/Demobilization	Lump Sum	$ 180,000	1	$ 180,000
2 Site Preparation	Lump Sum	$ 53,000	1	$ 53,000
3 Temporary Offices for construction period	Month	$ 3,000	4	$ 12,000
4 Temporary Utilities	Lump Sum	$ 5,000	1	$ 5,000
			Subtotal	$ 250,000
			% Total Costs	5%
REMEDIAL COMPONENTS				
Partial Source Material ("Hot Spot") Removal, Enhanced Bioremediation with Oxygen Injection, MNA, and NAPL Recovery				
1 Dewatering and Water Treatment System Mobilization/Removal	Lump Sum	$ 25,000	1	$ 25,000
1 Operation and Maintenance of the Water Treatment Equipment	Day	$ 1,500	30	$ 45,000
2 Wastewater Discharge Fess	1,000 Gallons	$ 5	1,600	$ 8,000
3 Excavation Support System Design	Lump Sum	$ 40,000	1	$ 40,000
4 Installation/Removal of Excavation Support System	Lump Sum	$ 525,000	1	$ 525,000
5 Soil Excavation	CY	$ 33	1,900	$ 62,700
6 Transportation and Disposal of Soil (thermal desorption)	Ton	$ 68	3,000	$ 204,000
7 Transportation and Disposal of Hazardous Waste Disposal	Ton	$ 71	-	$ -
8 Transportation and Disposal of Construction Debris	Ton	$ 86	100	$ 8,600
9 Transportation and Disposal of Contaminated Debris	Ton	$ 71	20	$ 1,420
10 Transportation and Disposal of Wastewater	1,000 Gallons	$ 400	20	$ 8,000
11 Approved Off-site Backfill Material - Granular Fill	Ton	$ 25	2,900	$ 72,500
12 Approved Off-site Backfill Material - Select Granular Fill - Slope Protection	Ton	$ 22	100	$ 2,200
13 Backfill to Grade	CY	$ 80	1,900	$ 152,000
14 Miscellaneous Site Restoration	Lump Sum	$ 15,000	1	$ 15,000
15 Odor Control	Drum	$ 490	20	$ 9,800
16 Excavation Standby Time	Day	$ 4,600	1	$ 4,600
17 Soil Amendment	Ton	$ 130	100	$ 13,000
18 Gravel Fill	Ton	$ 31	-	$ -
19 Cut and Cap Operations	Day	$ 6,100	-	$ -
20 Install O2 System Injection Wells, Piping	Ton	$ 350,000	1	$ 350,000
21 O2 System Equipment	Ton	$ 90,000	1	$ 90,000
22 NAPL Recovery Well Installation and Monitoring Well Installation	Day	$ 75,000	1	$ 75,000
			Subtotal	$ 1,686,820
			% Total Costs	34%
Long Term Groundwater Monitoring and System Maintenance				
1 Periodic Monitoring, Reporting, and Disposal (Present Value)	Year	$ 86,000	30	$ 1,322,031
assume discount rate (i)=5%			**Subtotal**	$1,322,031
			% Total Costs	27%
REMEDIAL COST SUMMARY				
Total Capital costs without contingency				$ 2,632,420
Total O & M costs				$ 1,322,031
Total Capital and O&M costs without contingency				$ 3,954,451
Contingency (25%)			25%	$ 988,613
			% Total Costs	20%
OST				**$ 4,943,063**

Note:

Differences between calculated total cost and reported total cost are due to rounding.

Table B-3
Opinon of Cost for Remedial Alternative 4
Glen Cove Former MGP Site
Glen Cove, New York

GEI Consultants, Inc. (GEI) has prepared this opinion of cost required to complete remediation of the Glen Cove former MGP site. GEI's opinion is based on published RS Means Cost Data, Vendor Costs, and on GEI's project experience. In order to prepare this estimate, GEI made basic assumptions as to actual site conditions that should be encountered; specific decisions and costs by other design professionals to be engaged by the contractor; the means, materials, methods of construction, and schedule the contractor will use/determine; and various other factors (see page 4 of 4 for list of specific assumptions). An actual contractor's bid price to perform this work may vary from this estimate based on variances in the above-mentioned assumptions.

Remedial Component	Unit	Unit Price	Quantity	Total Cost
COMMON COST COMPONENTS				
Preconstruction				
1 Engineering Design, Plans, Specs, Bid	Lump Sum	$ 400,000	1	$ 400,000
2 Permitting and Regulatory Submittals	Lump Sum	$ 100,000	1	$ 100,000
			Subtotal	$ 500,000
			% Total Costs	1%
Construction Management				
1 Construction Manager	Day	$ 1,068	700	$ 747,600
2 Resident Engineer	Day	$ 1,068	700	$ 747,600
3 Air Monitoring during construction	Day	$ 750	650	$ 487,500
4 Air Monitoring System	Month	$ 30,000	35	$ 1,050,000
5 Geotechnical and Structural Evaluation and Survey (includes Protection Costs)	Lump Sum	$ 100,000	1	$ 100,000
6 Site Survey (Post-Remediation)	Lump Sum	$ 6,200	1	$ 6,200
			Subtotal	$ 3,138,900
			% Total Costs	9%
General Conditions				
1 Mobilization/Demobilization	Lump Sum	$ 420,000	1	$ 420,000
2 Site Preparation (Temp fence and shrub removal)	Lump Sum	$ 70,000	1	$ 70,000
3 Temporary Offices for construction period +3 months	Month	$ 3,000	35	$ 105,000
4 Temporary Utilities	Lump Sum	$ 5,000	1	$ 5,000
			Subtotal	$ 600,000
			% Total Costs	2%
REMEDIAL COMPONENTS				
Restoration to Pre-Release Conditions				
1 Dewatering and Water Treatment System Mobilization/Removal	Lump Sum	$ 25,000	1	$ 25,000
1 Operation and Maintenance of the Water Treatment Equipment	Day	$ 1,500	1,050	$ 1,575,000
2 Wastewater Discharge Fess	1,000 Gallons	$ 5	3,440	$ 17,200
3 Excavation Support System Design	Lump Sum	$ 40,000	1	$ 40,000
4 Installation/Removal of Excavation Support System	Lump Sum	$ 525,000	1	$ 525,000
5 Soil Excavation	CY	$ 33	73,000	$ 2,409,000
6 Transportation and Disposal of Soil (thermal desorption)	Ton	$ 68	109,500	$ 7,446,000
7 Transportation and Disposal of Hazardous Waste Disposal	Ton	$ 71	-	$ -
8 Transportation and Disposal of Construction Debris	Ton	$ 86	1,000	$ 86,000
9 Transportation and Disposal of Contaminated Debris	Ton	$ 71	200	$ 14,200
10 Transportation and Disposal of Wastewater	1,000 Gallons	$ 400	20	$ 8,000
11 Approved Off-site Backfill Material - Granular Fill	Ton	$ 25	109,500	$ 2,737,500
12 Approved Off-site Backfill Material - Select Granular Fill - Slope Protection	Ton	$ 22	100	$ 2,200
13 Backfill to Grade	CY	$ 80	73,000	$ 5,840,000
14 Miscellaneous Site Restoration	Lump Sum	$ 30,000	1	$ 30,000
15 Odor Control	Drum	$ 490	2,086	$ 1,022,000
16 Excavation Standby Time	Day	$ 4,600	1	$ 4,600
17 Soil Amendment	Ton	$ 130	5,110	$ 664,300
18 Gravel Fill	Ton	$ 31	-	$ -
19 Cut and Cap Operations	Day	$ 6,100	-	$ -
			Subtotal	$ 22,446,000
			% Total Costs	67%
Long Term Groundwater Monitoring				
1 Periodic Monitoring, Reporting, and Disposal (Present Value)	Year	$ 32,000	5	$ 138,543
assume discount rate (i)=5%			**Subtotal**	$138,543
			% Total Costs	0%
REMEDIAL COST SUMMARY				
Total Capital costs without contingency				$ 26,684,900
Total O & M costs				$ 138,543
Total Capital and O&M costs without contingency				$ 26,823,443
Contingency (25%)			25%	$ 6,705,861
			% Total Costs	20%
			TOTAL COST	**$ 33,529,304**

Table B-4
List of Assumptions
Glen Cove Former MGP Site
Glen Cove, New York

GEI Consultants, Inc. (GEI) has prepared this opinion of cost required to complete remediation of the Glen Cove former MGP site. GEI's opinion is based o

General

Unit Cost Data from 2009 RS Means Heavy Construction Cost Data, Unit Cost Localization Factor (Hicksville) = 1.201

Design

GEI unit rates from the GEI National Grid MSA were used as typical costs for design, report preparation & oversight costs.
These rates are intended to reflect industry rates and not those of a specific consultant.

Preconstruction

3-4 Meetings with Regulatory Agencies (City, State).
Preparation of 2 local/county permits with 1 revision each.
No Dewatering/Discharge Permit is required (All dewatering liquids will be transported off site).

Construction Management

One construction oversight person on site during all construction activities. (12 hours/day).
One air monitoring oversight person onsite during all remedial activities. (10 hours/day).
Contractor Management Costs (additional meetings, permits, submittals) assume 10% of total construction costs.
Geotechnical & Structural Eval includes adjacent slope stability issues.

Mobilization and Site Preparations

One Frac tanks will be used for storage of decontamination/dewatering liquids (if any).
Trees and shrubs will be removed to clear access road.
Assume contractor haul distance from Site to Contractor shop was no greater than 75 Miles.
Assumed mobilization of one excavator and no more than four additional pieces of construction equipment.
Assumes 2 construction trailers, HVAC, Lighting, Temporary Utilities, and Phone Service.

Alternatives

Assume 30% porosity of soil
Standard Excavation Rate for 2.5 CY Bucket Excavator ~ 850 CY per 8 hr day or ~106 CY per hour
Assume 30-40% efficiency due to direct load, limited staging area, and remnant structures.
Therefore excavation rate decreases to ~ 32 CY per hour or ~ 255 CY per 8 hour day.
The excavation rate is based on 255 CY per day or ~400 tons per day.
Impacted Soil Disposal Costs based on quote from ESMI, Fort Edward dated January 12, 2009 and Contractor Bid for similar LI Site dated April 2009.
Impacted Dewatering liquid disposal costs based on email quote from United Industrial Services dated January 13, 2009 and similar LI site date April 2009.

Restoration

Parking Area will be restore with a 4-inch thick RCA base coarse, a binder coarse, and a top coarse.
6' Chain link fence will be restored where removed.
Trees will not be replaced.

Post Remedy Monitoring

Sampling required twice per year for up to 6 monitoring wells.
Laboratory contractor rates based on GEI MSA with STL Connecticut.
Assume one 12 hour work day, two sampling personnel per sampling event.
Discount rate of 5% per NYSDEC based on EPA July 2000, A Guide to Developing and Documenting Cost Estimates During t Feasibility Study (Recommended Rate 7%) and OSWER Directive 9355.3-20 “Revisions to OMB Circular A-94 on Guidelines and Discount Rates for Benefit-Cost Analysis” (USEPA 1993) (Recommended Rate 7%) and 2009 Discount Rates for OMB Circular No. A-94 (OSWER, 2009) (Recommended Rate 2.7%)